ELECTRICAL PARTICULAR SPECIFICATION

FOR

CITY COLLEGE PLYMOUTH
MARINE TECHNOLOGY CENTRE

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Project Revision Sheet

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PREFACE

The projects electrical specification is made up from two separate specifications which when combined together form the projects electrical specification. To understand the requirements of the projects electrical specification the documents shall be read together and not in isolation from one another. The documents forming the projects electrical specification are:

PMTC-SDP-XX-XX-SP-E-001: Electrical Performance Specification.
PMTC-SDP-XX-XX-SP-E-002: Electrical Y Section Specification.

V12 LV SUPPLY/PUBLIC UTILITY SUPPLY

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
A new incoming electrical supply has been provided to the building, this is shown on the electrical small power drawings.

100.020 STANDARDS
The complete installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- Health and Safety at Work Act.
- Health and Safety at Work Regulations.
- The Electricity at Work Regulations.
- The Electricity Safety, Quality and Continuity Regulations.
- District Network Operator - Conditions for Connection Works & Protection.
- BS7671 – The Requirements for Electrical Installations (18th Edition).
- BS7430 – Code of practice of Protective Earthing for Electrical Installations.
- National Joint Utilities Group Guidelines.

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION
The building shall be provided with a new incoming low voltage electricity supply derived from the local District Network Operators (DNO) electricity network.

This supply has been provided by others.

The new LV supply shall terminate within the cut out fuses located in the ground floor plant room.

All necessary attendances by the Contractor shall be included for in assisting and managing the DNO during the course of their works.

The Contractor shall be responsible for submitting all applications to the DNO and Meter Operator for the works and for liaising and coordinating with the DNO/meter operator at the school.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS
Refer to 200012-SDP-XX-XX-SP-E-002 ‘Y’ Sections for Reference Specifications.

V20 LV DISTRIBUTION

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
To provide the building with a new low voltage distribution system throughout for the safe delivery of power to sub-distribution boards, control panels, distribution boards and dedicated electrical systems or equipment.

100.020 STANDARDS:
The complete installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- Health and Safety at Work Act.
- Health and Safety at Work Regulations.
- The Electricity at Work Regulations.
- The Electricity Safety, Quality and Continuity Regulations.
- District Network Operator - Conditions for Connection Works & Protection.
- BS7671 – The Requirements for Electrical Installations (18th Edition).
- BS7430 – Code of practice of Protective Earthing for Electrical Installations.
- National Joint Utilities Group Guidelines.

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION:
The Contractor shall supply and install a new low voltage distribution system throughout the building in accordance with this specification and accompanying drawings, including the inspection, testing and commissioning of the system and setting the system to work.

The low voltage distribution system shall comprise a complete and fully functioning distribution system within each building comprising, but not limited to main low voltage switchboard, sub-distribution panels, final distribution boards and metering, cabling and containment systems.

A new LV switchboard shall be installed within the plant room connected to the new DNO incoming electrical supply and earthing system (refer to Section V12).

The main low voltage switchboard shall be:-

- Wall or floor mounted.
- Constructed to BS EN 60439-1.
- IP rated to a minimum IP31.
- Form 4A Type 2 to BS EN 60439.
- Steel Construction with powered coated finished.
- Top entry/exit cabling.
- Front access.
- Minimum 400A ASTA Certified bus bars with full sized neutral.
- Minimum fault level 50kA for 1 sec.
- Operating tolerances 400V ±10%, 50Hz ±1%,
- 100mm plinth (floor mounted switchboards only).

LV switchboard shall be provided with a minimum 10% spare protective devices representative of selected devices and a further 10% unequipped space ready to accept future protective device and fitted with blanking plates.

The switchboard shall be configured to enable future expansion to one side without impacting on access requirements within the plant room..

MCCB devices shall comply with BS 60947-2 comprising 2 pole or 4 pole device having adjustable

electronic (LSI) or thermal-magnetic (TM-D) protection. Overload and short circuit sensing shall be provided on 1 pole for 2 pole MCCB's and 3 poles for 4 pole MCCB's. All MCCB's shall be capable of being padlocked in the off position.

The LV switchboard shall be provided complete with digital MODBUS or similar type metering for all outgoing supplies. Metering shall be provided with CT's , fusing and connections fitted internally within the switchboard with meters fitted to front face of the switchboard. Meters shall be capable of monitoring, the following minimum parameters:

- Power (kW, kVA & kVAr)
- Voltage, all phase variations (i.e. L1-L2, L1-N etc)
- Current, all three phases.
- Power factor
- Total Power consumption (kWh)

Metering shall communicate using a Modbus metering facility connected to the BMS for remote monitoring / review and check billing purposes. Metering shall be linked to the building management system by the BMS Specialist.

Check billing meters shall be MID grade billing type meter.

Each energy meter shall be provided with an engraved traffolyte label clearly identifying the distribution equipment, system or item of equipment monitored.

A combination of dedicated, dual metered and split metered lighting and power final circuit distribution boards shall be provided for all general lighting and power throughout the building. Distribution boards shall be provided with miniature circuit breakers (MCB's), residual current circuit breakers (RCBO's) in compliance with requirements of BS 7671 and blanking plates cover spare ways where protection devices may be installed in the future.

MCB's, MCBO's shall be BS EN 60898 compliant and generally be type C for lighting circuits and type B for small power circuits as identified in the Distribution Board Schedules within this specification. MCB's, MCBO's complying with BS 60947-2 shall be provided where identified within the Distribution Board Schedules.

All final circuit distribution boards shall be provided complete with MODBUS digital meters to monitor the energy use of lighting and power separately, in compliance with the Part L .

Within the Science Classroom, CAD Room and Construction Skills Classroom, dedicated distribution boards shall be provided with an emergency power off (EPO) facility which when operated turns off the power to the distribution board outgoing final circuits.

Momentary action emergency power down buttons shall be provided within each workshop space with its dedicated board (as shown on the drawings), which when operated, powers down the local distribution board/outgoing circuits using an integral drop out contactor within the distribution board. A momentary action key reset switch shall be provided adjacent each distribution board which when operated reinstates the electricity supply to the isolated board/circuits.

A sign shall be installed adjacent each emergency power down button informing the use of the button and each sign shall be legible for people using the room. A traffolyte label shall be fitted to the key reset switch information its use and correct operations for reinstating the supply. A sample of the sign and label shall be submitted to the Engineer for approval prior to fixing.

A circuit chart is to be provided within each distribution board identifying the MCB rating, circuit number and area/equipment served by each final circuit. The chart shall be type written and inserted in a clear plastic wallet securely fixed to the back of the hinged distribution board door.

Distribution boards shall incorporate a door lock which can be secured using a key.

A compensation power factor correction unit shall be provided within the Plant room within the Post 16

Centre building to improve the power factor for the buildings. The unit shall comprise an automatic compensation low harmonic pollution unit. The unit shall comprise a bottom entry, steel enclosure, constructed to IP31, incorporating microprocessor controller with modbus communication, control contactors, double temperature control by thermostat and head circuit breaker protection.

A sub mains distribution system generally comprising of XLPE/SWA/LS0H cable shall be provided. All sub-main cables shall be labelled to indicate load connected/distribution board reference/origin reference, number of cores, cross sectional area (CSA) and approximate length. This shall be completed at both ends of the cable. Labels shall comprise of engraved traffolyte disc labels, attached to the cable by means of nylon tie wraps.

Cabling shall generally be installed concealed in ceiling / building voids and risers dropping to switch boards/panel and distribution board's surface on medium duty cable tray supported by proprietary wall mounted brackets. All cables shall be fully supported by the cable support system continuously over their entire length of run.

For multi-core cables LSOH covered, perforated aluminium cable strapping, such as 'all round banding' or similar, fixed with pins and nuts shall be used for fixings or nylon claw type cable cleats with dual bolt fixings or single bolt fixings will be used.

All cables will be installed and run such that they are arranged in an orderly manner and to minimise the number of crosses. Cables will be fixed in groups of 4 cables complete with 2no cable diameters distance maintained between cable groups.

Cabling supplying life safety systems e.g. sprinklers, fire alarm and emergency voice communication systems shall be carried out using fire resistant cabling and fixings in accordance with the accompanying drawings and as described within BS8519 for the relevant equipment/ system being supplied, and in accordance with the cable manufacturer's recommendations.

Cabling serving life safety equipment shall be affixed to cable tray using the cable manufacturers recommended fixings.

SWA type cabling shall be terminated internally using the cable manufactures recommended BW type brass compression glands, CW type glands shall be used for when terminating cabling externally.

The complete installation shall be inspected, tested and commissioned on completion. The Contractor shall provide confirmation through the Principal Contractor when it is considered the installation is complete and they are ready to provide all attendances and offer the installation for inspection and demonstration in the presence of the Engineer. A subsequent date shall be arranged for demonstrations of the installation and systems to the Client or their representative. Where the installations required a specialist to be appointed, the specialist shall also be available for the demonstrations.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS
Refer to 200012-XX-XX-SP-E-002 'Y Sections' for reference specifications.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO V20.

300.000 PRODUCTS/MATERIALS

300.012 METERING Type
- Check metering of energy use.
- Make provision for check metering to comply with Building Regulations AD L2A - L2B as appropriate.

310.000 WORKMANSHIP

310.010 INSTALLATION:
- Install distribution pillars in accordance with manufacturer's recommendations.

V21 CONTAINMENT SYSTEMS
PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
To provide the building with a new cable support and containment systems to support and to provide mechanical protection to cabling and wiring systems installed throughout the building.

100.020 STANDARDS:
The complete installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- Health and Safety at Work Act.
- Health and Safety at Work Regulations.
- The Electricity at Work Regulations.
- The Electricity Safety, Quality and Continuity Regulations.
- District Network Operator - Conditions for Connection Works & Protection.
- BS7671 – The Requirements for Electrical Installations (18th Edition).
- BS7430 – Code of practice of Protective Earthing for Electrical Installations.
- National Joint Utilities Group Guidelines.

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION:
The Contractor shall be required to supply and install a new cable support and containment systems as detailed within this specification and as shown on the accompanying drawings.

The design shall be extended by the Contractor to accommodate cable weights, deflection supports, fixings and capacities etc and provide any additional cable trunking, tray, basket or ducts deemed necessary to provide a fully cable support and containment installation. Primary cable support and containment systems shall generally comprise:

Cabling System	Cable Support & Containment System
Main low voltage tails/cabling.	Cable trunking, galvanised steel.
Main/Sub-main low voltage cabling.	Internal - Medium duty return flange, galvanised steel. External - Heavy duty return flange, galvanised steel.
Low voltage final circuitry	Heavy duty cable basket, galvanised steel.
Data & Voice cabling	Heavy duty cable tray, galvanised steel.
Fire alarm cabling & emergency voice communication system.	Heavy duty cable tray, galvanised steel.
Extra low voltage cabling e.g. access control, CCTV, intruder alarms, call	Heavy duty cable tray, galvanised steel.
Separate extra low voltage systems	High Impact rigid uPVC conduit.

All cable trays shall be slotted having an Admiralty pattern.

A concealed installation shall generally be provided throughout the building. The cable support and containment systems shall be installed concealed within accessible floor, ceiling or building voids with the exception of plant rooms, switch rooms, electrical switch / riser cupboards where an exposed installation may be provided.

A local exposed surface installation may also be provided where cable support and containment systems drop or rise from voids to surface mounted switchgear, distribution boards, mechanical control panels, server and data cabinets, and other main head end equipment or cabinets e.g. public address, telecom, broadband equipment.

The cable support and containment systems shall remain continuous throughout their entire length. Changes of direction shall be provided by using the manufacturer's proprietary bends, tee's, crossovers and sets. Where proprietary bends, tee's, crossovers and sets for the cable support or containment system are not manufactured by the manufacturer e.g. cable basket, on-site bends, tee's, crossovers and sets shall be constructed in accordance with the manufactures written instructions. All cut metalwork shall be treated with proprietary corrosive preventative paint. All tee's, bends and cross pieces of cable support and containment systems shall incorporate a 45° gusset each side from the point of intersection.

Where cabling systems are shown on the accompanying drawings to be supported and contained using a multi-compartment containment system, the cabling systems shall be segregated from one another using a solid galvanised earthed steel divider running the full length of the containment system.

Where primary containment systems pass through building compartment walls and floors, proprietary bracket work / supports shall be placed within 300mm either side from the wall or floor penetration to support the containment system. Where lids are provided e.g. trunking systems, a short section of lid shall be permanently secured to the containment system where it passing through the wall or floor.

All trunking lids shall be provided with minimum 4no turnbuckle fixings symmetrically distributed on either side / end of the lid to ensure the lid will remain secure to the trunking.

The manufacturer's proprietary earth bonding links shall be installed across all joints of the cable support and containment systems to ensure that earth continuity is maintained throughout the length of each cable support and containment system.

The installation of all cable support and containment systems shall be fully coordinated with the architectural and structural elements of the building and with other trades to ensure an accessible and easily maintainable installation is provided throughout.

Physical separation and segregation of cable support and containment systems shall be maintained throughout the installation to reduce the effects of electromagnetic interference between cable band circuits.

The Contractor shall provide a secondary cable support and containment installation throughout the building comprising the following:

Cabling System	Cable Support & Containment System
Low voltage final circuitry	Rigid galvanised steel conduit. Multi-compartment dado /skirting trunking.
Data & Voice cabling	Rigid galvanised steel conduit. Multi-compartment dado /skirting trunking.
Fire alarm cabling	Rigid conduit, galvanised steel.
Emergency voice communication cabling	Rigid conduit, galvanised steel.
Extra low voltage cabling e.g. access control, CCTV, intruder alarms, call systems etc	Rigid conduit, galvanised steel.
Separate extra low voltage systems	High Impact rigid uPVC conduit.

In general the electrical installation shall be a surface mounted installation with cabling being drawn through rigid galvanised steel conduits within the voids and dropping surface mounted on walls below ceilings and above floor voids

Fire alarm system cabling shall be clipped to the building fabric using proprietary fire-rated red coated

copper cable clips, screws and rawl plugs as recommended by the cable manufacturer and drop concealed flush within walls to manual call points, wall mounted sounders and vad units.

The electrical installation shall be a surface mounted installation with surface mounted accessories provided throughout including plant rooms/spaces and ceiling ceiling voids

Accessories shall be mounted onto a single or double gang surface mounted galvanised steel box having 3 fixed and 1 adjustable fixing lugs, earth terminal and conduit knockouts. Mounting boxes shall be securely fixed on walls.

To minimise acoustic noise transfer between rooms, any back to back mounted electrical accessories shall be installed staggered (minimum 150mm) on each side of the wall. All flush mounting boxes within partitions or acoustically lined walls shall have acoustic back boxes/putty pads installed having a sound insulation requirement ≤ 45dB Rw. Where acoustic putty pads are used, the Contractor shall coordinated their installation with the Main Contractor prior to commencement of the wall construction, to ensure additional acoustic treatment within the wall construction is applied.

All surface mounting boxes shall have 3 fixed and 1 adjustable fixing lugs and an internal earth terminal. The mounting box shall be compatible with the accessory faceplate being installed particularly to ensure the mounting box is the correct size for the faceplate and corner profiles match.

A multi-compartment metal trunking installation shall be provided within workshops, classrooms teaching walls, learning spaces offices. The metal trunking shall have 3 compartments and be complete with all bends, coupler, stop ends, accessory mounting boxes, covers, fixings and fasteners to provide a complete installation. Metal trunking runs greater than 15m length shall be provided with internal earthed screen facility running the full length of the trunking to reduce electro-magnetic interference.

Dado trunking shall be compatible for use with the structured cabling system being installed.

Cable access shall be provided using vertical dado trunking drops from within the ceiling void. Flexible conduit connections shall be made from the primary / secondary containment systems within the ceiling void to the wiring compartments within the dado trunking.

Multi-compartment metal dado trunking shall be provided within workshops, classrooms, learning spaces and offices.

3 compartment metal trunking shall be provided on the teaching wall within the areas detailed on the drawings. Cabling shall access each trunking compartment back entry using 2x25mm flush conduit end box / conduit drop from the ceiling void. Each section of continuous metal trunking shall be provided with a minimum of two cable access points, located at each end of the metal trunking.

All service penetrations through fire compartment floors, walls and ceilings shall be fire stopped throughout the building. Fire stopping shall be installed in accordance with BS 9999 Code of practice for fire safety in the design, management and use of building and in accordance with BS 476 Fire tests on building materials and structures. Fire stopping shall be installed using third party certification for the product to be used in the location installed.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS
Refer to 200012-XX-XX-SP-E-002 'Y Sections' for reference specifications.

V22 GENERAL LIGHTING

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
To provide a fully functional internal lighting and control system within the building for the control of the visual environment and provide energy savings through automated controls.

100.020 STANDARDS:
The complete installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- The Health and Safety at Work Act
- The Electricity at Work Regulations.
- Health and Safety at Work Regulations.
- Building Regulations.
- BS7671 - The Requirements for Electrical Installations (18th Edition).
- BS7430 – Code of practice for protective earthing of electrical installations.
- BS 12464-1:2011 – Lighting of Work Places
- CIBSE Lighting Guide LG5 – Lighting for Education.
- ILP Guidance for the Reduction of Obtrusive Light.
- National Joint Utilities Group Guidelines.

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION:
The Contractor shall supply and install a new fully functional internal lighting and control system within the building in accordance with this specification and accompanying drawings, including the inspection, testing and commissioning and setting the installation to work.

The installation shall generally comprise, but not be limited to, new LED luminaires, fixings and supports, lighting control units, marshalling boxes, automatic controls, cabling systems, containment and accessories.

Luminaires shall be as detailed in the Schedule of Luminaires located within the appendix of this specification.

Luminaires shall be supplied, installed and connected complete with all glassware, diffusers, louvers, covers, gaskets and lamps as specified. Where possible diffusers and other glass type covers should be fitted as late as possible to ensure they are not soiled. All covers, diffusers, accessories shall be clean ready for practical completion, and all lamps shall be working correctly.

The Contractor shall provide all necessary support to ceiling systems for recessed and surface mounted luminaires to adequately support luminaire weight. Provide plywood backing sheet for recessed lights.

- Where recessed down lights are specified, these are to be supported by means of a plywood pattress fitted to the back of the ceiling tile so that support is taken from the ceiling grid system. A suitable hole shall be provided through the tile and pattress so that the fitting can be fitted using the standard manufacturers support clips.

- Where modular luminaires are to be incorporated into suspended and plaster board ceilings, the Contractor shall liaise with the Main Contractor and their Specialist Ceiling Contractor to provide sufficient ceiling supports/suspensions to ensure the ceiling system can support the weight of the luminaires. All luminaires shall be secured to the ceiling grids using proprietary brackets supplied by the luminaire manufacturer.

- Where luminaires are to be suspended, suspension kits supplied by luminaire manufacturer shall be used to support the luminaires from an appropriate fixing from the building fabric or secondary steel channel support system provided by the Contractor with all suspensions installed in vertical alignment. The final flex connection to the luminaire shall be neatly secured to the suspension wire making allowance where the flex leaves the suspension for movement in the luminaire when suspended.

- Where luminaires are to be installed surface they shall be supported by means of a plywood pattress fitted to the back of the ceiling tile, or provided within the partition construction, or where secured directly onto block work wall.

Cabling shall be carried out using T&E, LS0H 6242B cables distributed within galvanised steel basket and / or rigid galvanised conduit system. Cable drops to accessories shall be surface mounted within metal conduit. Surface mounted galvanised conduit shall be installed on fair face block work walls .

Lighting circuits shall be protected by miniature circuit breakers (MCB). MCB's shall generally be Type C and shall be manufactured and sourced from the same range as the distribution board which they are installed.

Final circuitry shall be as detailed in the Distribution Board Schedule located within the appendix of this specification.

Accessories shall generally be plastic finish with contrasting faceplate (graphite) and rocker switch to meet Equality Act and Part M requirements except in workshop areas, store rooms and plant rooms/spaces where metal clad type accessories shall be used. Ingress protection rated accessories shall be used externally or in areas where the environmental conditions require.

Further information is detailed within the Schedule of Specialist Suppliers, Manufactures and Materials located within the appendix of this specification.

Final connection to luminaires shall generally comprise plug-in lighting control modules (LCM) or marshalling box (MB) installed within accessible position within ceiling voids. LCM's and MB's shall be installed within 300mm to the underside of the LCM above the rear of the ceiling tile / plasterboard ceiling affixed to the building fabric (small rooms) or supported by proprietary galvanised barcketwork / threaded rod suspensions. Where LCM's or MB's are not used e.g. plant rooms / spaces corridors, WC's, sports hall etc each luminaire shall be connected using an individual multi-pin 16A GST plug and socket ceiling rose and flex arrangement.

LCM's and MB's shall be used for final connection to luminaires and controls outside of the room they are installed i.e. flexes passing through walls to a LCM or MB within another room.

Where luminaires are directly connected to the fixed wiring e.g. lighting trunking, some plant rooms etc. the fixed wiring shall be provided with heat shrink sleeving protecting the individual conductors entering and within the luminaire.

Fire / smoke barriers shall be provided externally where conduits pass through the fire rated ceilings and again internally at each end of the conduits once the flex has been installed.

Flex connecting luminaires shall be a minimum 1.0mm², flexible, multi-core, 300/500v cu/LSOH flex. All flexes shall be clipped neatly across suspended ceilings supported by proprietary caddy style clips fixed to the suspended ceiling support system (T bar) .

All service penetrations through fire compartment floors, walls and ceilings shall be fire stopped throughout the building. Fire stopping shall be installed in accordance with BS 9999 Code of practice for fire safety in the design, management and use of building and in accordance with BS 476 Fire tests on building materials and structures. Fire stopping shall be installed using third party certification for the product to be used in the location installed.

The complete installation shall be inspected, tested and commissioned on completion. The Contractor shall provide confirmation through the Principal Contractor when it is considered the installation is complete and they are ready to provide all attendances and offer the installation for inspection and demonstration in the presence of the Engineer. A subsequent date shall be arranged for demonstrations of the installation and systems to the Client or their representative. Where the installations required a specialist to be appointed, the specialist shall also be available for the demonstrations.

100.035 LIGHTING PARAMETERS

The internal lighting design has been designed based on the following lighting criteria specified in CIBSE Lighting Guide LG5 – Lighting for Education.

Interior Horizontal and cylindrical Illumination Criteria:

Types of Space	Horizontal Illuminance			Cylindrical Illuminance (WP height 1.2m)		Glare
	$\bar{E}_m$ lx	U_o	Task height (m)	$\bar{E}_z$ lx	U_o	UGR_L
Teaching and group rooms	500	0.6	0.70	150	0.1	19
Practical spaces where higher lighting level is needed: workshops, laboratories and preparation areas	500	0.6	0.85	150	0.1	19
Staff and administration, including reception area	500	0.6	0.75	50	0.1	19
Storage	100	0.4	0	-	-	25
Circulation	200	0.4	0	50	0.1	25
Lockers, cloakrooms toilets and changing,	150	0.4	0	-	-	25

Surface Illumination Criteria:

Areas	**Vertical Illuminance**	
	$\bar{E}_m$ lx	**U_o**
Whiteboards	150	0.6
Shelving and racking	100	0.4
Teaching spaces:	50% of horizontal task illuminance or E_v min>100lx (walls) 30% of horizontal task illuminance or E_h min>50lx (ceiling)	0.1 0.1
Offices:	75 (walls) 50 (ceiling)	0.1 0.1
Circulation:	50 (walls) 30 (ceiling)	0.1 0.1

Interior Luminaires Light Source Criteria:

Criteria	LED Luminaires
Colour	CCT: 4000K CRI: 80 MCAD: 3
Efficacy	In accordance with AD L
Design Life	Rated life: 30,000 hours min L: 70% B: 50%
Driver	Power Factor: 0.9 min Flicker factor: > 15% Dimming range: 1-100%
IP	General Areas: IP2X WCs, science areas: IP44 Plants Space: IP65
Luminaire Warranty Period (inc LED's, components, optics & body)	5 years

100.040 CONTROL REQUIREMENTS:
The lighting controls strategy shall be as indicated in this specification and on the drawings.

A Contractor shall appoint a Lighting Control Specialist to programme, test and commission the lighting control system.

Lighting control shall be provided throughout the building to facilitate the control of the visual environment and to provide energy savings.

Lighting controls shall be provided to comply with the strategy indicated on the accompanying lighting drawings for lighting control.

Where multiple LCM's or MB's are located within a room or space, they shall be interfaced together to provided a fully functional control system.

All luminaires shall be provided with electronic ballasts compatible for communication and control by the DALI lighting control system.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS
Refer to 200012-XX-XX-SP-E-002 'Y Sections' for reference specifications.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO V22

300.000 GENERAL

300.010 SYSTEM REQUIREMENTS:
- Select lighting control equipment suitable to meet system objectives requirements.

300.020 INSTALLER SELECTION:
- Engage lighting control equipment specialist to develop the design, supply, install, commission and set to work the lighting control system.

300.030 ELECTROMAGNETIC COMPATIBILITY:
- Ensure all equipment and systems are installed to provide electromagnetic compatibility within the

systems and with any other systems installed in the same location.

300.060 LIGHTING EQUIPMENT SCHEDULES:
- Supply lighting equipment in accordance with
  - Luminaire and Control Schedule
- Location of schedules
  - Within the appendix to this specification.

320.000 WORKMANSHIP

320.010 WORK ON-SITE:
- Ensure that all building works are completed and service connections are provided,
- By others.

320.020 INSTALLATION:
- Install, commission and set to work lighting control equipment in accordance with manufacturer's recommendations and BS 7671. Install infrared transmission systems and co-ordinate the installation of infrared systems in the same area in accordance with BS 7693.

320.030 QUALITY CONTROL:
- Handle, store and install equipment and components of the lighting control system in accordance with the manufacturer's recommendations.
- Obtain all equipment and components from a single source.
- Inspect all equipment and components on delivery, before fixing and after installation, and reject and replace any that are defective.

Record all commissioning, measurements and tests.

V23 GENERAL LV POWER

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
To provide a fully functional low voltage small power installation to serve small power outlets and equipment throughout the building.

100.020 STANDARDS:
The complete installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- Health and Safety at Work Act.
- Health and Safety at Work Regulations.
- The Electricity at Work Regulations.
- The Electricity Safety, Quality and Continuity Regulations.
- District Network Operator - Conditions for Connection Works & Protection.
- BS7671 – The Requirements for Electrical Installations (18th Edition).
- BS7430 – Code of practice of Protective Earthing for Electrical Installations.
- National Joint Utilities Group Guidelines.

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION:
The Contractor shall supply and install a new fully functional small power installation for the building in accordance with this specification and accompanying drawings, including the inspection, testing and commissioning of the installation and setting the small power system to work.

The new small power installation shall generally comprise but not be limited to providing single and double switched socket outlets, industrial type switched socket outlets, switch / un-switched fused connection units, double pole switches, multi-pole switch disconnectors and isolators, protection devices, containment and cabling systems.

All circuits shall be cabled using standard circuit arrangements.

All socket outlet circuit arrangements shall be connected onto standard ring or radial circuits configured to provide high integrity earthing. High integrity earthing shall be using the dual circuit protective conductors (cpc) inherent in ring circuits and by providing a duplicate cpc for radial circuit. Two earth terminals shall be provided on all electrical accessories connected to high integrity earthing circuits. Accessories shall have two separate earth terminals in order to facilitate high integrity earthing.

The Contractor shall select and install fuses within fused connection units as per manufacturer's guidelines for the equipment they are serving.

Dedicated power supplies shall be provided connected to standard radial circuits to serve dedicated items of equipment or systems. The Contractor shall generally supply, fix, wire and connect local power supplies as necessary as shown on the accompanying drawings and as detailed in the Distribution Board Schedules and generally, but not limited to the equipment or systems below:

- Access control and intercom systems.
- Closed circuit television system.
- TV distribution systems.
- Audio frequency loop induction systems.
- Fixed furniture fittings and equipment

- Hand dryers.

The location and installation of power supplies required for the systems, equipment and appliance scheduled above shall be co-ordinated with the respective specialists and supplies and architectural drawings.

Hand dryers shall be supply, fix, wire and connect electric hand dryers generally as required throughout the building. The dryers shall be wired via 13A D.P. switched fused connection units (SFCU) allocated at high level, with final connections concealed in wall fabric to a back box located behind the dryer. Final connection from the SFCU to the hand dryer shall be carried out using heat resistant 3 core 1.5mm² flex.

The Contractor shall provide electrical power supplies for mechanical equipment not supplied from mechanical control panels. The location and installation of power supplies required for mechanical plant and equipment shall be co-ordinated with the Mechanical Contractor. Circuits feeding mechanical plant shall be sized and rated as per manufacturer's guidelines for the equipment they are serving. Final electrical connections shall be the responsibility of the Mechanical Contractor.

Several localised items of ventilation plant identified on the drawings are to be automatically switched off during a building fire alarm condition. A drop out contactor shall be provided adjacent distribution boards with its control circuit interfaced with the building fire alarm system. On initiation of a fire alarm condition the drop out contactor shall automatically switch off the electrical supply to the plant. On resetting the fire alarm condition the supply to the plant shall automatically be reinstated.

A dedicated distribution board shall be provided within server room to serve local power supplies to equipment and services within the room. Data cabinet shall be supplied by an industrial type socket outlet controlled by a local switch dis-connector adjacent the distribution board. The circuit shall be configured for high integrity earthing using the single circuit protective conductor provided by the final circuit. Data cabinet shall be provided with a selection of power distribution units and leads to allow final connection of the active equipment within the data cabinet.

Within all workshop and technical classrooms dedicated distribution boards shall be provided with an emergency power off (EPO) facility which when operated turns off the power to the distribution board outgoing final circuits.

Momentary action emergency power down buttons shall be provided within each workshop and technical learning spaces which when operated powers down the local distribution board/outgoing circuits using an integral drop out contactor within the distribution board. A momentary action key reset switch shall be provided adjacent each distribution board which when operated reinstates the electricity supply to the isolated board/circuits.

Small power circuits shall generally be protected with type B miniature circuit breakers or residual current breakers except where specific type is requested by equipment manufacture.

Cabling shall be carried out using T&E, LS0H 6242B cables distributed within galvanised steel basket and / or rigid galvanised conduit system. Cable drops to accessories shall be surface mounted on walls. Surface mounted galvanised conduit shall be installed on fair face block work walls.

Small power circuits shall generally be protected by type B miniature circuit breakers (MCB) or residual current breaker within overload (RCBO) devices. MCB's and RCBO's shall be manufactured and sourced from the same range as the distribution board which they are installed.

Final circuitry shall be as detailed in the Distribution Board Schedule located within the appendix of this specification.

Accessories shall generally be metal finish with contrasting faceplate (graphite) and rocker switch to meet Equality Act and Part M requirements except plant rooms/spaces where metal clad type accessories shall be used. Ingress protection rated accessories shall be used externally or in areas where the environmental conditions require.

Further information is detailed within the Schedule of Specialist Suppliers, Manufactures and Materials located within the appendix of this specification.

The complete installation shall be inspected, tested and commissioned on completion. The Contractor shall provide confirmation through the Principal Contractor when it is considered the installation is complete and they are ready to provide all attendances and offer the installation for inspection and demonstration in the presence of the Engineer. A subsequent date shall be arranged for demonstrations of the installation and systems to the Client or their representative. Where the installations required a specialist to be appointed, the specialist shall also be available for the demonstrations.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS
Refer to 200012-XX-XX-SP-E-002 'Y Sections' for reference specifications.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO V23

300.000 GENERAL

300.010 LV POWER EQUIPMENT SCHEDULES:
- Supply LV power equipment as

Schedules within the appendix of this specification.

V40 EMERGENCY LIGHTING

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
To provide a new emergency lighting system to provide escape lighting, safety lighting and standby emergency lighting should the normal artificial lighting system fail.

100.020 STANDARDS:
The complete installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- The Health and Safety at Work Act
- The Electricity at Work Regulations.
- Building Regulations.
- BS7671 - The Requirements for Electrical Installations (18th Edition).
- BS 5266-1 - Emergency lighting. Part 1: Code of practice for the emergency lighting of premises
- BS EN 13032-3 - Measurement and presentation of photometric data of lamps and luminaires. Part 3 Presentation of data for emergency lighting of work places.
- BS EN 50172:2004, BS 5266-8:2004 - Emergency escape lighting systems.
- BS EN 1838 - Lighting applications. Emergency lighting
- SLL CIBSE LG12/15 for emergency lighting in general.
- Projects Fire Strategy report.

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION:
The Contractor shall supply and install an emergency lighting system within the building in accordance with this specification and as detailed on the accompanying drawings.

Emergency escape lighting shall be provided throughout the building to the place of safety in accordance with the latest editions of BS 5266, BS EN 1838, Building Regulations Part B and the building fire strategy report.

The system shall assist escape from the building by providing emergency escape route lighting, open area “anti-panic” emergency lighting, specific areas with enhanced emergency lighting and high risk emergency lighting.

Escape route emergency lighting shall be provided to all mandatory “points of emphasis” throughout the buildings generally as detailed below:

- At each exit door intended to be used in an emergency.
- Near stairs so that each flight of stairs receives direct light.
- Near any other change in level.
- Mandatory emergency exits and safety signs.
- At each change of direction.
- At each intersection of corridors.
- Near to each final exit.
- Outside the building to a place of safety identified in the fire strategy report.
- Near each first aid post.
- Near each piece of fire fighting equipment and call point.

(Near indicates within 2 meters)

Additional emergency luminaires shall be installed along all defined escape routes throughout the building to provide sufficient illumination for escape purposes and to provide additional exit signage, in

order to highlight the shortest route to emergency exits. Open areas (≥60m²) shall be provided with emergency lighting to reduce panic during escape.

Enhanced emergency lighting shall be provided to the following rooms/ spaces in accordance with Annex E, Table E1 of BS 5266-1:
.

- Refuge areas for people with mobility impairment.
- Plant rooms, switch rooms and lift winding facilities.
- Fire alarm CIE.
- Access control “push to egress and emergency green break glass” release switches.

High risk task areas shall be provided with a much higher emergency illumination level to enable the task to be safely controlled and terminated when the normal internal lighting fails. High risk task areas are:

- CNC
- Technical Classrooms
- Composites

Over and above those requirements above, emergency lighting shall also be provided within the following rooms/spaces:

- Accessible toilet facilities, multi-closeted toilets greater than 8m² and toilets without borrowed light.
- Occupied spaces with no borrowed light.
- Areas ≤60m² forming part of the escape route.

Emergency luminaires shall comprise self contained units having a local battery back facility and provided as standalone emergency luminaires or having the battery backup facility incorporated into the general lighting luminaires.

All emergency luminaires shall be LED type units with a battery pack having a 3 hour minimum duration. Refer to the luminaire schedule for further details.

Battery packs shall be supplied from the mains off the local general lighting circuit with the emergency facility arranged to operate upon failure of the mains to the local lighting circuit. All battery packs shall be provided in accordance with ICEL recommendations.

All remote battery packs shall be suitably supported using a proprietary support system within ceiling voids. Resting battery packs loose on the back of luminaires or ceiling finishes will not be acceptable.

All supports for luminaires shall be provided in accordance with the supports provided for the internal general lighting installation.

All emergency luminaires shall feature integral green/red status LEDs to indicate local healthy ‘charging’ and fault indication. All status LED’s shall be located in the position where they can be easily identified and viewed at floor level.

Stand-alone emergency luminaires shall feature ‘corridor ‘or ‘area’ optics to distribute the light efficiently according to the area being illuminated.

Illuminated emergency exit signage shall be the provided throughout the building to highlight the shortest route to emergency exits in compliance with BS 5266-2, BS EN 1838 and the building fire strategy. Luminaires illuminated exit signs shall incorporate a pictogram to the latest British Standards and European Signs Directive.

The emergency lighting system shall use the same cabling and installation method provided for the general lighting system.

Final connections to emergency luminaires / battery packs within the building shall be carried out using a minimum 1.5mm² multi-core flex supplied from either a 16A GST multi-pin plug or socket arrangement, marshalling box (MB) or lighting control module (LCM). All roses, marshalling boxes and LCM shall be located with the ceiling voids, 300mm above the ceiling line.

All flexes shall be clipped to the suspended ceiling tee bar using a proprietary caddy style clip. Flexes shall follow the lines of the suspended ceiling grid and shall not be clipped diagonally across the top of ceiling tiles.

All flexes providing final connections to luminaires shall be installed above, off the ceiling using a propriety caddy type clip/bracket arrangement.

All service penetrations through fire compartment floors, walls and ceilings shall be fire stopped throughout the building. Fire stopping shall be installed in accordance with BS 9999 Code of practice for fire safety in the design, management and use of building and in accordance with BS 476 Fire tests on building materials and structures. Fire stopping shall be installed using third party certification for the product to be used in the location installed.

The complete installation shall be inspected, tested and commissioned on completion. The Contractor shall provide confirmation through the Principal Contractor when it is considered the installation is complete and they are ready to provide all attendances and offer the installation for inspection and demonstration in the presence of the Engineer. A subsequent date shall be arranged for demonstrations of the installation and systems to the Client or their representative. Where the installations required a specialist to be appointed, the specialist shall also be available for the demonstrations.

100.040 CONTROL REQUIREMENTS:
Emergency lighting shall be provided with manual test key switches located adjacent the local distribution boards, using phase barrier switches where multiple electrical phases are present.

Circuitry and switching lines shall be arranged to ensure the test switches only affect the operation of emergency luminaires and do not affect the normal operations of other electrical equipment or luminaires.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS
Refer to 200012-XX-XX-SP-E-002 'Y Sections' for reference specifications.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO V40.

300.000 GENERAL

300.010 EMERGENCY LIGHTING SYSTEM:
- Standard
  - BS EN 50172 (BS 5266-8) for emergency escape lighting systems.
  - BS 5266-2 for low mounted way guidance systems for emergency use.
  - BS EN 1838.
  - BS 5266-1 for general recommendations and guidance for the emergency lighting in premises other than dwellings.
  - SLL CIBSE LG12/15 for emergency lighting in general.
- Type of system
  - Escape route lighting.
  - Open area (anti-panic) lighting.
  - High risk task area light.
  - Standby lighting.
    - Not applicable
- Category of operation (Annex F of BS 5266-1):
  - Type
    - X - self contained.

- Mode of operation
  - 0 - non-maintained.
  - 1 - maintained.
- Duration of emergency mode (in minutes) for a self-contained system (10 to indicate 10 minutes duration):
  - 180 to indicate 3 hr duration.
- Power source
  - Self contained emergency luminaires.
- Type of premises
  - Education
  - Sleeping accommodation.

300.020 ILLUMINATION OF SIGNS:
- Application
  Illuminate exit, emergency exit and escape route signs so that they are legible at all times, by
  - lamps contained within sign.

310.000 PRODUCTS/MATERIALS

310.010 LAMPS FOR EMERGENCY LIGHTING:
- Lamp
  - LED.

310.020 SELF-CONTAINED EMERGENCY LIGHTING LUMINAIRE SYSTEM AND EQUIPMENT:
Standard - BS EN 60598-2-22.
- Categories
  - Non-maintained.
  - Maintained.
- Batteries for self-contained luminaires
  - Sealed nickel-cadmium cells.
  - Jelly electrolyte sealed lead-acid cells.
  - Absorbed electrolyte gas recombination sealed lead-acid cells.
- Type
  - Self-contained luminaire.
  - Self-contained illuminated sign.
  - Self-contained modification (conversion) units.
- Ancillaries
  - Red/Green LED indicator.

310.040 BATTERY CHARGERS:
- Standard - BS EN 60335-2-29, (battery chargers for household and similar applications), relevant parts of BS EN 60146, (semiconductor converters), BS EN IEC 62485-2 (stationary secondary batteries and battery installations), BS EN 50171 (central power supply systems) and ICEL 1009:2000
- Charging Techniques
  - Constant current.
  - Constant voltage.
  - Taper charging.
  - Trickle charging.

310.060 ANCILLARIES:
Provide ancillaries in accordance with the appropriate standards and regulatory authority requirements.
- Accessible test switch.
  - For luminaire groups.

320.000 WORKMANSHIP

320.010 INSTALLATION:
- Install, test and commission emergency lighting system and luminaires in accordance with the relevant parts of BS 5266, BS EN 50172 (BS 5266-8), BS EN 1838 and BS 7671 (IET Wiring Regulations).

320.020 SELF-CONTAINED LUMINAIRES:
- Ensure self-contained luminaires are not installed where temperatures are likely to exceed manufacturers recommended maximum.
- Ensure fluorescent luminaires are not used at temperatures below that specified by manufacturer.

320.030 EQUIPMENT:
- Install equipment in accordance with manufacturer's recommendations.

320.040 QUALITY CONTROL:
- Record all commissioning measurements and tests and site modifications to hardware or software, and revise operating and maintenance instructions accordingly.
- Manage configuration of software settings, data and design, in accordance with an appropriate Configuration Management Plan (CMP), complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.
- Provide configuration details along with the operation and maintenance manual on hand-over. Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

W10 TELECOMMUNICATIONS

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
To provide a new analogue telephone installation within the building to provide a backup telephone service to the colleges voice over internet protocol (VOIP) telephone system.

100.020 STANDARDS:
The complete installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- Health and Safety at Work Act.
- Health and Safety at Work Regulations.
- The Electricity at Work Regulations.
- BS 7671 (IET Wiring Regulations)
- BS EN 50174 (PARTS 1 to3) information technology cabling.
- PD CLC/TR 50174-99-1 information technology cabling remote powering installations.
- BS 6701 telecommunications equipment and telecommunications cabling.
- BS EN 62949 particular requirements for equipment to be connected to information and communication technology networks.
- BS EN 60950-1 safety of information technology equipment.
- BS EN 62368-1 safety requirements for audio, video and information technology equipment
- Publicly available telephone service provider.

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION:
The Contractor shall supply and install an analogue telephone installation within the proposed building to provide backup telephony services as detailed in this specification and shown on the accompanying drawings.

The Contractor shall supply and install within the building an internal copper distribution point, containment, cabling and telephone outlets for the following services:

- Office– Back-up telephone.
- Intruder alarm system – Dial out facility to alarm receiving centre.
- Lift – Dial out facility to alarm receiving centre.

Internal distribution points shall comprise a Krone connection box 201D or similar.

Cabling shall be carried out using multi-core, CW 1308 and supported by the data and voice cable basket and / or rigid galvanised conduit system. Cable drops to accessories shall be flush, concealed within walls using uPVC plastic conduit. Surface mounted galvanised conduit shall be installed on fair face block work walls, external store rooms, plant rooms/spaces.

A single accessory mounting box shall be provided at each telephone position for the connection and installation of the master telephone outlet by the Service Provider. Sufficient cable length shall be provided at each telephone outlet and distribution point to allow the final connection of the telephone lines by the Service Provider.

The final location for telephone outlet connecting to the lift shall be coordinated with the lift installation. Final connection of the telephone line with the lift installation shall be carried out by the lift specialist including the inspection, testing and commissioning of the remote alarm link to the alarm receiving centre.

All orders for incoming telephone lines from their preferred service provider shall be placed by the college.

Active back-up telephone handsets shall be provided and installed by the college's ICT Specialist.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATION
Refer to 200012-XX-XX-SP-E-002 'Y Sections' for reference specifications.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W10.

300.000 GENERAL

300.010 TELECOMMUNICATIONS SYSTEMS:
- Supply, install, commission and set to work a telecommunications system.
- Standards
  - BS 7671 (IET Wiring Regulations)
  - BS EN 50174-1 information technology cabling installation specification and quality assurance
  - BS EN 50174-2 information technology cabling installation planning and practices inside buildings
  - BS EN 50174-3 information technology cabling installation planning and practices outside buildings
  - PD CLC/TR 50174-99-1 information technology cabling remote powering installations
  - BS EN IEC 62485-1 general requirements for secondary batteries and battery installations
  - BS EN IEC 62485-2 requirements for stationary batteries and battery installations
  - BS EN 50310 earthing and bonding in buildings with information technology equipment
  - BS 6701 telecommunications equipment and telecommunications cabling
  - BS EN 62949 particular requirements for equipment to be connected to information and communication technology networks
  - BS EN 60950-1 safety of information technology equipment
  - BS EN 62368-1 safety requirements for audio, video and information technology equipment
- Publicly available telephone service provider
- System apparatus
  - Telephones.

300.020 APPROVALS:
- Ensure that all apparatus and equipment provided for the telecommunications system complies with the provisions of the Radio and Telecommunications Terminal Equipment Regulations 2000 as amended, and where necessary the Communications Act 2003 as amended by the Electronic Communications and Wireless Telegraphy Regulations 2011.

300.040 TELECOMMUNICATIONS SPECIALIST:
- Engage a specialist to carry out all aspects of supply, installation, setting to work and handing over to designated maintainer of the telecommunications system.

300.050 ELECTROMAGNETIC COMPATIBILITY:
- Ensure all equipment and systems and equipment are designed and installed in accordance with due consideration to good EMC practice, and in line with the EMC requirements of relevant standards including BS 6701, BS 7671, BS EN 50310, BS EN 50174-1, BS EN 50174-2, BS EN 50174-3.
- Ensure all equipment complies with the EMC Regulations 2016, carries the CE Mark, and is suitable for the electromagnetic environment in which it is to be used, for the service to which it is to be put.

300.060 REMOTE POWER FEEDING SYSTEM:
- Ensure that when remote power feeding systems are used they comply with BS EN 60950-21 or BS ISO/IEC/IEEE 8802-3 and that appropriate safety precautions and devices are installed to protect the user and service persons.

310.000 PRODUCTS/MATERIALS

310.050 TELEPHONES:
- Provide telephones in accordance with the schedule reference Telephones
  - Conform to The Radio and Telecommunications Terminal Equipment Regulations 2000 as amended.

320.000 WORKMANSHIP

320.010 WORK ON-SITE:
- Ensure that all building works are completed and service connections are provided in accordance with the requirements.
- By others

320.020 QUALITY CONTROL:
- Handle store and install all equipment, apparatus and components of the telecommunications system in accordance with BS 6701, BS 7671, and the manufacturer's recommendations.
- Inspect all equipment, apparatus and components on delivery, before fixing and after installation and reject and replace any which are defective.
- Record all commissioning measurements and tests.
- Manage configuration of software, settings, data, and design, in accordance with an appropriate Configuration Management Plan complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.
- Provide configuration details along with the operation and maintenance manual on hand-over.
- Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.
- Provide certification and test reporting in accordance with BS 6701 and BS 7671 along with the commissioning records, and the operation and maintenance manual on hand-over.

320.030 INSTALLATION:
- Install telecommunications systems in accordance with BS 6701, BS 7671, and the manufacturer's recommendations.

W15 FACILITIES FOR THE DISABLED

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
To provide a complete and fully functional system to assist the disabled when using the buildings and providing compliance with the Equality Act.

100.020 STANDARDS:
The complete installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- The Health and Safety at Work Act
- Building Regulations AD(M).
- The Electricity at Work Regulations.
- Health and Safety at Work Regulations.
- BS8300-1- Design of an Accessible and Inclusive Built Environment, Code of Practice
- BS8300-2 - Design of an Accessible and Inclusive Built Environment, External Environment.
- BS7671 - The Requirements for Electrical Installations (18th Edition).

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION:
The Contractor shall supply and install a disabled WC call system within the building in accordance with this specification and as shown on the accompanying drawings. The information shown on the drawings is indicative and is provided to show design intent only.

The Contractor shall appoint a Call Specialist who shall extend the design, supply, install, programme, test and commission and set the system to work. The supply and installation of all containment systems for the call systems shall be carried out by the Contractor.

Call systems shall generally comprise ceiling mounted pull cord switches, reset buttons and over door light linked back to a multi-zone control and indication panel located within the building. Pull cord switch shall have integral reassurance lamps and be complete with red pull cord with dual anti-bacterial dual toggles.

Control and indicating panel (CIE) within the building shall generally comprise a 4 zone, zone controller supplied from 12V power supply unit. The CIE shall be located within the Office with cabling emanating from the control panel, this shall be wired on a zone by zone basis and distributed throughout the building to rooms having a call facility.

All CIE power supply units shall be supplied with a battery backup facility.

The cabling design, sizing, construction etc for the system shall be carried out by the appointed Specialist. Cabling shall generally comprise a multi-core flexible cabling system with LS0H over sheath compliant with the equipment manufacturers' recommendations

Cabling shall be installed using the extra low voltage cable tray (ELV compartment) and when leaving the tray contained in metal conduits using a proprietary conduit take off plate. The installation shall generally be a surface mounted installation.

The Contractor shall fire stop all service penetrations throughout the building. Fire stopping shall be installed in accordance with BS 9999 Code of practice for fire safety in the design, management and use of building and in accordance with BS 476 Fire tests on building materials and structures. Fire stopping shall be installed using third party certification for the product to be used in the location installed.

The complete installation shall be inspected, tested and commissioned on completion. The Contractor shall provide confirmation through the Principal Contractor when it is considered the installation is complete and they are ready to provide all attendances and offer the installation for inspection and demonstration in the presence of the Engineer. A subsequent date shall be arranged for demonstrations of the installation and systems to the Client or their representative. Where the installations required a specialist to be appointed, the specialist shall also be available for the demonstrations.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS
Refer to 200012-XX-XX-SP-E-002 'Y Sections' for reference specifications.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W15

300.000 GENERAL:

300.010 ELECTROMAGNETIC COMPATIBILITY:
- Ensure all equipment and systems are designed and installed with due consideration to good electromagnetic compatibility practice and in line with electromagnetic compatibility requirements of relevant standards including BS 7671
- Ensure all equipment complies with the Electromagnetic Compatibility Regulations 2016, carries the CE Mark, and is suitable for the electromagnetic environment in which it is to be used, for the service to which it is to be put.

300.020 DISABLED ALARM SPECIALIST:
- Engage a specialist to develop the design, supply, install, commission and set to work the disabled alarm systems.
- Specialist as detailed in the Schedule of Specialist Suppliers, Manufacturers and Equipment.

300.040 STANDARD:
- Ensure accessibility of user controls, including labelling, conforms to BS 8300-1 and BS 8300-2.
- Ensure equipment is selected and installed in accordance with BS 7671.

310.000 PRODUCTS/MATERIALS:

310.010 DISABLED ALARM CONTROL:
- Method of displaying calls
- 10 zone panel
  - Individual lamp for each call point.
  - Type of lamps
  - LED Red
  - Call accept push button
  - Reset push button
  - Integral sounder
  - Mimic diagram
- Audible warning of calls constant tone for normal calls

310.020 DISABLED ALARM CONTROL POWER SUPPLY UNIT:
- Input
  - Mains
  - Standby 7Ahr battery
  - Separate battery
    - Battery, enclosure and charging system complies with BS EN IEC 62485-1 and BS EN IEC 62485-2
  - Remote battery backup kit
- Output
  - DC

- Nominal 12 Volts
- Current rating 300mA
  - Smoothing

310.030 CALL AND RESET UNIT:
- Mounting
  - Ceiling mounted pull cord, bangles as AD M 4.30e
  - Wall-mounted reset unit
  - Flush.
- Facilities
  - Reset button
  - Push button
  - Reassurance light
  - Integral sounder
  - Call unit
    - Pull cord switch
    - Reassurance lamp
    - 2 triangular bangles on cord, antibacterial
  - Reassurance lamp
    - LED amber or red lens. Microphone.

310.050 OVER DOOR/CORRIDOR LAMP AND LOCAL SOUNDER UNIT:
- Mounting
  - Wall
- Twin lamps ultra bright
- Lamp type ultarbright LED
  - Minimum 2.5 Watts
- Lens
  - Material
    - Polycarbonate.
    -
  - Colour
    - Amber.
    - Red.
- Sounder

320.000 WORKMANSHIP:

320.010 WORK ON-SITE:
- Ensure that all building works are completed and service connections are proved,

320.020 INSTALLATION:
- Install commission and set to work facilities for the disabled in accordance with the manufacturer's recommendations and the appropriate standard.

320.030 QUALITY CONTROL:
- Handle, store and install equipment and components of the facilities for the disabled in accordance with the manufacturer's recommendations.
- Obtain all equipment and components from a single source unless otherwise instructed.
- Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
- Record all commissioning measurements and tests and site modifications to hardware or software, and revise operating and maintenance instructions accordingly.
- Manage configuration of software, settings, data, and design, in accordance with an appropriate Configuration Management Plan complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.
- Provide configuration details along with the operation and maintenance manual on hand-over.

W21 PROJECTION

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
To provide a containment system for AV projection cabling within teaching and learning spaces as indicated on the drawings.

100.020 STANDARDS:
The complete installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- The Health and Safety at Work Act
- The Electricity at Work Regulations.
- Health and Safety at Work Regulations.
- BS7671 - The Requirements for Electrical Installations (18th Edition).
- BS 6701
- BS EN 50173
- BS EN 50174

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION
The Contractor shall supply and install a containment system for use by the colleges AV specialists for the installation of college supplied AV outlets and wiring looms for display screens, projectors etc in accordance with this specification and as accompanying drawings.

Each teaching wall location shall be provided with a twin mounting box and blanking faceplate, for the use by the colleges AV Specialist, within the dado trunking adjacent the teacher's desk. The AV wiring loom shall be installed from the AV outlet plate within the dado trunking exiting through the tee section provided and connected to the display equipment.

Each classroom shall be provided with a 13A D.P. switched fused connection unit within the teaching wall dado trunking for use by the AV specialist to power the teaching wall monitor.

A single mounting box and structured cabling data outlet shall be provided within the dado trunking adjacent to the Teaching wall monitor to provide an ethernet connection to the monitor. A patch cable shall be installed from the outlet and looped within the dado back into the dado trunking exiting through the tee section provide and patched in to the display monitor.

All AV outlet pates supplied and installed by the colleges AV specialist shall include the following outlets:

- 2no HDMI outlet.
- 1 VGA outlet.
- 1no. USB outlet.
- 1no 3.5mm audio jack outlet.

The Contractor shall fire stop all service penetrations throughout the building. Fire stopping shall be installed in accordance with BS 9999 Code of practice for fire safety in the design, management and use of building and in accordance with BS 476 Fire tests on building materials and structures. Fire stopping shall be installed using third party certification for the product to be used in the location installed.

The AV installation shall be inspected, tested and commissioned on completion by the colleges AV Specialist. The Contractor shall provide confirmation through the Principal Contractor when it is

considered the installation is complete and they are ready to provide all attendances and offer the installation for inspection and demonstration in the presence of the Engineer. A subsequent date shall be arranged for demonstrations of the installation and systems to the Client or their representative. Where the installations required a specialist to be appointed, the specialist shall also be available for the demonstrations.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATION
Refer to 200012-XX-XX-SP-E-002 'Y Sections' for reference specifications.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W21.

300.000 GENERAL

300.040 ELECTROMAGNETIC COMPATIBILITY:
- Ensure all equipment is compatible, and does not adversely affect, nor is adversely affected by, any other equipment installed in the same location.
- Ensure all systems are designed and installed with due consideration to good EMC practice, and in line with EMC requirements of relevant standards including: BS 7671, BS EN 50310, BS EN 50174 series.
- Ensure all equipment complies with the EMC Regulations 2016, carries the CE Mark, and is suitable for the EM environment in which it is to be used, for the service to which it is to be put.

300.050 SAFETY STANDARDS:
- Provide projection equipment complying with BS EN 62368-1, BS EN 60950-1 BS EN 60065 and BS EN 60335-2-56 as appropriate.
- Ensure the design of equipment, its location and mounting arrangements consider accessibility for safe installation, commissioning and maintenance.

320.000 WORKMANSHIP

320.010 WORK ON-SITE:
- Ensure that all building works are completed and service connections are provided,
  - by others

320.020 QUALITY CONTROL:
- Handle, store and install all equipment and components of the projection system in accordance with the manufacturer's recommendations and
  - BS EN 61938
- Inspect all equipment and components on delivery before fixing and after installation, and reject and replace any which are defective.
- Record all commissioning measurements and tests, and site modifications to hardware or software and revise operating and maintenance instructions accordingly.
- Manage configuration of software, settings, data and design, in accordance with an appropriate Configuration Management Plan complying as necessary with BS EN ISO 9001, BS ISO 10007, BS ISO/IEC/IEEE 12207 and BS ISO/IEC/IEEE 15288.
- Provide configuration details along with the operation and maintenance manual on hand-over.
- Manage information security of systems, software and data during design, implementation and commissioning in line with BS EN ISO/IEC 27001.

320.030 INSTALLATION:
- Install projection system cabling systems in accordance with the manufacturer's recommendations and
  - BS EN 61938
- BS 7671

W41 SECURITY DETECTION AND ALARM

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide a complete fully functional intruder detection and alarm system.

100.020 DESIGN PARAMETERS
The complete design, installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- The Health and Safety at Work Act
- The Electricity at Work Regulations.
- Health and Safety at Work Regulations.
- BS EN 50130 – Alarm Systems, Environmental and Electromagnetic Comparability.
- BS EN 50131 (all parts) – Alarm Systems, Intrusion and Hold Up Systems.
- BS EN 50132 (all parts) – Alarm Systems, CCTV Surveillances Systems for use in Security Applications.
- BS EN 50136 (all parts) – Alarm Systems, Alarm Transmission Systems.
- BS 8473 – Intruder and hold up alarm systems. Management of false alarms. Code of practice.
- BS 8243 - Association of Chief Police Officers (ACPO) code of practice.
- PD6662 – Implementation of European Standards for Intruder Alarm Systems
- BS7671 - The Requirements for Electrical Installations (18th Edition).
- BS7430 – Code of practice for protective earthing of electrical installations.
- BS 5979 Code of Practice for remote centres with alarm systems.

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION
The Contractor shall supply and install new intruder detection and alarm system with the building in accordance with this specification and as shown on the accompanying concept drawings. The information shown on the drawings is indicative and is provided to show design intent only.

The Contractor shall appoint an Intruder Alarm Specialist who shall extend the design, supply, install, programme, test and commission and set the system to work. The supply and installation of all containment systems for the intruder detection and alarm system shall be carried out by the Contractor.

The intruder alarm specialist shall be an accredited member of the National Security Inspectorate (NSI) and shall have been approved been to Gold approval by the NSI.

The intruder alarm system shall comprise an open protocol Grade 3 system.

Intruder alarm devices within the building shall generally consist of keypads, door contacts, movement detectors, internal sounders and external siren activated sounder units cabled backed to local zone expanders.

The panel shall communicate with zone expanders using the systems network bus cabling system, each building served by a dedicated network bus cable.

Intruder alarm devices within the building shall generally consist of keypads, door contacts, movement detectors, internal sounders and external siren activated sounder units cabled backed to local zone expanders.

The main intruder detection and alarm panel shall be located within Reception. The panel shall

communicate with zone expanders using the systems network bus cabling system, each building served by a dedicated network bus cable.

The intruder alarm security system shall be in accordance with EN 50131-1, enhanced with NSI PD 6662 and BSI DD243 and shall use sequential verification of alarms and signal to key holders / police (if required).

Remote key pad shall be located internally adjacent the main entry/exit point into the building. An audible warning sounder shall be incorporated in the system to give indication when the entry/exit circuit is operating.

Zone expanders shall be installed at accessible locations within ceiling voids, M&E plant spaces and riser cupboards.

Magnetic door contacts shall be installed to all external doors providing entry/egress to the building and to key internal doors where identified on the drawings.

Dual technology microwave/passive infra red technology shall be provided to monitor rooms, areas and spaces for intrusion.

External siren activated bell unit shall be provided for the building and arranged to only operate for intrusion within the building concerned. SAB unit shall have triple tamper protection, 115db twin LEDs, xenon beacon and shall be provided to the front and rear of the building.

The intruder alarm system shall be in accordance with EN 50131-1 enhanced with NSI PD 6662 and BSI DD243 and provide a sequential verification of alarms throughout the building.

The Contractor and their appointed specialist shall provide all necessary power supplies, cabling, containment and accessories to complete a fully functioning intruder alarm system.

The cabling design, sizing, construction etc for the system shall be carried out by the Intruder Alarm Specialists. Cabling shall generally comprise a multi-core flexible cabling system with LS0H over sheath compliant with the equipment manufacturers' recommendations.

Cabling shall be installed using the extra low voltage cable tray (ELV compartment) and when leaving the tray contained in metal conduits using a proprietary conduit take off plate. The installation shall generally be surface mounted in all areas.

The Contractor shall fire stop all service penetrations throughout the building. Fire stopping shall be installed in accordance with BS 9999 Code of practice for fire safety in the design, management and use of building and in accordance with BS 476 Fire tests on building materials and structures. Fire stopping shall be installed using third party certification for the product to be used in the location installed.

The complete installation shall be inspected, tested and commissioned on completion. The Contractor shall provide confirmation through the Principal Contractor when it is considered the installation is complete and they are ready to provide all attendances and offer the installation for inspection and demonstration in the presence of the Engineer. A subsequent date shall be arranged for demonstrations of the installation and systems to the Client or their representative. Where the installations required a specialist to be appointed, the specialist shall also be available for the demonstrations.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS
Refer to 200012-SDP-XX-XX-SP-E-002 'Y' Sections for Reference Specifications.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W41

300.000 GENERAL

300.010 SYSTEM REQUIREMENTS:
Select security detection components and equipment, suitable to meet system objectives requirements.

300.020 INTRUDER ALARM SPECIALIST:
Use a security detection specialist for design development, supply, installation and testing and commissioning of complete security installation.

- Security detection specialist shall be as detailed in the Schedule of Specialist Suppliers and Materials

300.030 RECOGNISED FIRM:
Engage a firm recognised by the National Approval Council for Security Systems to carry out the specified work on the security detection and alarm system to the appropriate NACOSS and NSI Code of Practice.

- Recognised Firm
- Class of Recognition Gold approval
- Category of Recognition
  - Certificated.
  - Approved.

300.050 STANDARDS:

- BS 4737-2.
- BS 4737-3
- BS 7230.
- BS EN 50131-1.
- BS EN 50131-6.
- BS EN 50132.
- BS EN 50134-1.
- BS EN 50134-2.
- BS EN 50134-3.
- BS EN 50134-7.
- BS EN 50136.
- PD 6608.

300.060 INTRUDER ALARM GRADING CLASSIFICATION:
Ensure the intruder alarm system complies with the requirements of BS EN 50131-1

- Security grade
  - Medium-to-high risk, grade 3
    - Standby time Type A 24h.
    - ATS option,
  - Component Environmental classification
    - Indoor, class I,
    - Indoor - general, class II,
    - Outdoor - sheltered, class III,
    - Outdoor - general, class IV,

300.065 INTRUSION ALARM:
Assist in extend the design, supply, installation, testing, commissioning, and setting the system to work of the intrusion alarm system.

300.070 INTRUDER ALARM TRANSMISSION SYSTEM PERFORMANCE:
Ensure the intruder alarm system transmission system performance complies with the requirements of BS EN 50131-1 Annex B

- Transmission time classification,
- Reporting time classification,
- Availability classification,
- Substitution security protection method,

- Information security protection method,

300.080 INTEGRATION WITH OTHER SYSTEMS:
Integrate other systems with intruder alarm systems to form a complete system complying with the requirements and the appropriate standards.

300.090 ELECTROMAGNETIC COMPATIBILITY:
Ensure all equipment and systems are installed to provide electromagnetic compatibility within the system and with any other systems installed in the same location, in accordance with BS EN 50130-4.

310.000 PRODUCTS/MATERIALS

310.010 VISIBLE AND AUDIBLE WARNING DEVICES:
- Standard
  - BS 4737-2.
  - BS 4737-4.3.
  - BS EN 50131-1.
- Use
  - Principal.
  - Supplementary.
- Lamp
  - Flashing.
  - Steady.
  - Wall mounting.
  - Weatherproof.
  - Colour of lens
- Sounders
  - Klaxon.
  - Bell.
  - Siren.
  - Internal.
  - External.
  - External to BS EN 50131-1.
- Colour
  - Manufacturer's standard.
- Finish
  - Weatherproof.
  - Internal.
- Power supply
  - From control unit
  - Integral.
  - BS EN 50131-1.
- Accessories
  - Fit line monitor device.
  - Cut off timer; time (sec)
  - Two tone modulation.
  - Delay sounding

310.020 POWER SUPPLIES:
- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Standard
  - BS EN 50131-6 and BS 4737-2.
  - BS 4737-4.1

- Provide
  - Primary battery.
  - Primary battery with second battery as reserve.
  - Rechargeable battery.
  - Mains supply with rechargeable battery standby.
  - Integral with control equipment.
  - Individual sensor or detector power supply.
  - Automatic dialling equipment power supply.
  - Digital communications power supply.
  - Direct line signalling equipment power supply.
  - 12 V.
  - Voltage

310.070 COMBINED INFRA-RED-MICROWAVE DOPPLER DETECTORS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Standard
  - BS 4737-3.4 and BS 4737-3.7.
  - BS 4737-4.3.
  - BS EN 50131-1.
  - MPT 1353.
- Coverage
- Mounting
- Power Supply
  - From control unit.
  - Integral

310.150 CONTINUOUS WIRING:

- Standard
  - BS 4737-3.1.
  - BS 4737-4.1.
- Circuit Configuration
  - Alternative wires short circuit alarm.
  - Adjacent wires short circuit alarm.
  - Combined
- Mounting
  - Direct attachment.
  - Single layer.
  - Transverse wiring.
  - Wiring in tubes.
  - Wiring in grooved rods.

310.190 DELIBERATELY OPERATED DEVICES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Standard - BS 4737-3.14.
- Characteristics
  - Type X.
  - Type Y.

    - Type Z.
    - Non latching.
    - Latching.
    - Normal.
    - Quiet.
    - Hand operated.
    - Foot operated.
    - Portable wire free.

310.290 ALARM MONITORING SYSTEM:

- Type
- Application
- Manufacturer and reference
    - Or approved equivalent
- Standards
    - BS 4737-4.1.
    - BS 4737-4.2.
    - BS EN 50131-1.
- Operating procedures
    - Setting
    - Unsetting
    - Setup/Unsetting to BS EN 50131-1.
    - System operative in working hours
    - 24 hour circuits
    - Alarm on unsetting outside expected time frame
- Final setting
    - Key operated unlock
    - Push-button
    - Exit door switch
    - Timed
    - Exit route detector
- Initial unsetting
- Characteristics
    - Simple audible alarm.
    - Local audible alarm only.
    - No alarm on deliberately-operated device actuation.
    - Event time recording.
    - Event recording to BS EN 50131-1.
    - Identification of actuated detector.
    - System redundancy
    - Alarm transmissions.
    - Duress unsetting facility
    - Double knock alarm indication
    - Coincident alarm initiation
    - Circuit identification
    - Programming to BS EN 50131-1
    - Programming
    - Alarm and fault indication
    - Performance
- Mounting
    - Location
- Power supply
    - Integral
- Equipment
    - Microprocessor.
    - VDU.

- Input keyboard.

310.300 ALARM TRANSMISSION:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Use
  - Main.
  - Standby.
- Standard
  - BS EN 50131-1.
  - Radiocommunications Agency Specification
- Form of transmission
  - Private wire.
  - PSTN.
  - Radio
- Characteristics
  - Dedicated path
  - Digital communicator
  - Automatic dialling
  - Voice communicator.
  - Number of attempts to establish communications
  - Unsuccessful communication alarm
  - Ringing-in alarm.
  - Line fault alarm.

310.310 REMOTE CONTROL CENTRES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Provide and operate manned and unmanned remote centres, satellite stations and central stations for intruder alarm systems
- Facilities
- Standard
  - BS 5979

310.330 INTER CONNECTING WIRING:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Standard
  - BS 4737-3.30.
  - Flexible to BS 4737-2.
  - Flexible to BS EN 50131-1.
  - Optic fibre signalling
- Characteristics
  - Solid conductor.
  - Stranded conductor.
  - Tinsel conductor.
  - Number of cores
  - Number of twisted pairs
  - Screen

- Optic fibre cable make-up

320.000 WORKMANSHIP

320.010 INSTALLATION:
Install, commission and set to work equipment in accordance with manufacturer's recommendations and
- BS 4737-4.1.
- BS 4737-4.3.
- BS 7230.
- BS EN 50131-1.
- BS EN 50134-1.
- BS EN 50134-2.
- BS EN 50134-3.
- BS EN 50134-7.
- HTM 2015.

320.020 WORK ON SITE:
Ensure that all building works are completed and service connections are proved,
- By others.

320.030 QUALITY CONTROL:
Handle, store and install equipment and components of the security detection and alarm systems in accordance with the manufacturer's recommendations. Obtain all equipment and components from a single source unless otherwise instructed.
Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Record all commissioning measurements and tests.

320.040 DOCUMENTATION:
Provide full documentation to comply with
- BS 4737-2.
- BS 4737-4.1
- BS 4737-4.3.
- BS 7230.
- BS EN 50131-1.
- BS EN 50134-1.
- BS EN 50134-2.
- BS EN 50134-3.
- BS EN 50134-7.

320.060 CABLE INSTALLATION:
Install cables as required. Protect cables from mechanical damage.
- Standard
  - BS 4737-4.1.
  - BS 4737-4.2.
  - BS 4737-4.3.
  - BS EN 50131-1.
- Jointing - no joints permitted.
- Terminations
  - Wrapped
  - Crimped.
  - Soldered.
  - Clamped.
  - IDC.
  - Plug and sockets
- Support intermediate wiring in,

- Conduit.
- Steel trunking.

320.070 PARTIAL OPERATION:
Commission and set to work before handover of the complete system those parts and areas of the system defined in:
- Schedule

320.080 INSTALLATION SUPERVISOR:
Nominate the individual to be completely responsible for the installation, commissioning and setting to work. Provide such details on this individual as required.

W50 FIRE DETECTION AND ALARM

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide a complete and fully functional site network fire detection and alarm system w.

100.020 STANDARDS
The complete design, installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- The Health and Safety at Work Act
- The Electricity at Work Regulations.
- Health and Safety at Work Regulations.
- BS5839-1 – Fire Detection and Alarm Systems for Buildings.
- BS7671 - The Requirements for Electrical Installations (18th Edition).
- BS7430 – Code of practice for protective earthing of electrical installations.
- Project Fire Strategy Report.

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION
The Contractor shall supply and install new fire detection and alarm system in accordance with this specification and as shown on the accompanying concept drawings. The information shown on the drawings is indicative and is provided to show design intent only. The proposed system shall be fully compatible and integratable with the schools existing access control system

The appointed Fire Alarm Specialist shall design, supply, install programme, test and commission and set the system to work. The supply and installation of all containment systems for the fire alarm system shall be carried out by the Contractor.

The fire detection and alarm specialist shall be an accredited member of the Loss Prevention Certification Board (LPCB) and be registered with the British Approvals for Fire Equipment (BAFE) with SP201 and SP203-1 accreditation.

The system shall be provided to BS 5839-1 category L2 throughout the building in line with the building fire strategy and based on a single stage simultaneous evacuation of the building.

The fire detection and alarm system shall comprise an open protocol analogue addressable system.

Fire alarm control and indicating panel shall be located in the vicinity of the main entrance and shall communicate using the secured fire alarm network. The control and indicating panel shall include the following minimum requirements:

- An LCD text display capable of reporting the location of alarms and fault conditions etc.
- Alpha numerical keypad permitting navigation, reset, mute, silence, resound, evacuate and 4no programmable push buttons.
- Control via a key enable switch or alternative means of protection to temporarily disabled third party systems e.g. ventilation, door hold open magnets etc during adhoc testing and to isolate remote monitoring to the alarm receiving centre where provided.
- Separate LED zone indication for each fire alarm zone within the building.
- An integral printer (except Engineering Block).
- Surface mounted enclosure.

The system shall comprise manual call points, automatic detectors and sensors, electronic sounders, interface units and visual alarm devices wired on addressable loops connected to the fire alarm

system control and indication equipment.

The Fire Alarm Specialists shall review the locations of manual call points, automatic detectors, sounders and visual alarms etc shown on the concept drawings for compliance with the standards and for maintenance access with the architectural plans for the building and adjust where necessary for compliance.

Drawing plans shall be provided by the Fire Alarm Specialist detailing the detection and alarm circuit routing, and device numbering and addressing.

A manual call point shall be provided adjacent the fire alarm panel and throughout the building.

Call points shall be red, non-addressable, key operated call points and be monitored by the addressable fire alarm system using a proprietary zone monitor unit. The key operated call point shall be corrosion resistant and constructed of flame retardant plastic. The key operated call point shall be designed to have the key withdrawn when a fire alarm call has been initiated and for the key to be reinserted and returned to its normal position for resetting the call point.

Call points shall be arranged into conventional circuits to suit the detection zones within the building. The final call point on each circuit shall be provided with an end of line device to allow monitoring of the circuit by the addressable fire alarm system. Each internal call point shall be provided with a transparent hinged cover.

Automatic detection shall be provided throughout the building using addressable optical smoke or optical heat type multi-sensor detectors as indicated on the drawings. The sensor shall incorporate a microprocessor, photoelectric smoke chamber or be combined with and the thermister heat sensing elements using algorithms that include a time element, to provide an increased immunity to false alarm whilst maintaining the earliest warning of real fire condition.

Addressable Heat detectors incorporating ‘fixed’ temperature or ‘rate of rise’ sensing elements shall be provided within key rooms or spaces within the building where it has been considered optical smoke detection would be unsuitable.

All detectors shall be individually addressable with built-in LED alarm indicator and output circuit for remote LED alarm indicator. All detectors shall fit to a common base and be provided with an interlocking system to allow reinsertion of different detection devices into the same base.

Automatic smoke detection shall be provided in voids spaces greater than 800mm in depth in those areas defined by the category of protection in BS 5839-1. Each automatic detector shall be provided with a remote LED indicator installed to the underside of the ceiling tile directly beneath the detector. All ceiling void detectors shall be located in fully accessible locations within the ceiling voids.

Short circuit isolator modules shall assess and provided by the Fire Alarm Specialist in accordance with the requirements of BS 5839-1 and shall automatically isolate wire-to-wire short circuits on a signalling line circuit loop.

All aspirating smoke detection systems shall be monitored by the fire alarm system for fire and fault conditions.

Electronic addressable fire alarm sounders shall be provided throughout the building in order to achieve the required alarm audibility levels.

Visual alarm devices (VAD’s) shall also be provided to supplement audibility levels in noisy environments and to aid people having special needs or hearing impediments. This shall be achieved using a combination of loop driven sounder bases, combined / VAD base units or combined electronic sounder / VAD units. All beacons shall be VAD units compliant with BS EN54-23.

Where disabled refuge intercoms are present, local sounders in the immediate area of the refuge call station shall be avoided to allow clear voice recognition when using the intercom system.

The fire alarm interface units shall be installed to provide the following interface and control of third party systems. The Contractor and Fire Alarm Specialist shall allow for undertaking all connections and providing all equipment necessary to facilitate the connection.

The systems to be interfaced comprise:

- EVACS system - Engage refuge intercom units.
- Access Control (Electronic) - Locking mechanisms to fail unsecure.
- Mechanical plant/control panels – Shut down plant.
- Ventilation Systems – Shut down plant.
- Plant room gas solenoid valve – Isolate gas supply.
- Electrically operated fire shutters – Close fire shutters.
- Passenger lift – Lifts to return and remain on ground floor.

Fire alarm panel shall be provided with a key switch to temporarily disable the operation of the interface units during testing and maintenance of the fire alarm system.

All fire alarm control, detection and alarm equipment shall be operational at 24 volts DC, with the system power supply units being suitable for use on 230 volt AC systems. All fire alarm supply shall be supplied from the main LV switchboard/panel with protection devices provided with a permanent labelled 'FIRE ALARM – DO NOT SWITCH OFF'.

Local isolation shall be provided adjacent to the fire alarm panel or mains power interface units using an ESP fused key-switch complete with green status indicator. The switch shall be coloured red and provided with an engraved label 'FIRE ALARM - DO NOT SWITCH OFF.

Power supply cabling shall be carried out using a flexible fire resistant cabling system in red, zero halogen low smoke and fume sheath e.g. Pirelli Plus or Draka FT 120. All cables shall comply with the Enhanced performance requirements as detailed within BS 5839.

Batteries shall be of the sealed lead acid or nickel cadmium type, comprising sufficient cells to provide a nominal 24V DC supply to the alarm system under all operating conditions.

The battery capacity shall be sufficient to cover the standing load for *72* hours *followed by an* alarm load for 30 minutes upon a normal AC power failure where the system is monitored remotely by an alarm receiving centre.

All power supply units shall be complete with a static type charger/rectifier compatible with the batteries and be compliant to EN54. The charger shall be capable of fully recharging the battery within 48 hours whilst maintaining the system standing load.

A unique sound signature and operating time period shall be assigned to each type of annunciation programmed into the fire alarm system. The options available for the sound signature/operating time periods shall be presented to the Client with the agreed sound signatures approved in writing by the schools representative/agent.

Fire alarm circuits shall be designed in accordance with the layout shown upon the drawings. Wiring of remote addressable devices from each fire alarm panel shall be carried out using continuous loops with conventional devices using radial circuits. 25% spare connection and load capacity shall be provided upon each loop and associated loop card to allow enable additional devices to be easily added in the future.

Detection circuits shall be capable of providing, as a minimum, monitoring of open and short circuits together with monitoring of the removal of detector heads. Circuits shall be arranged such that the removal of any detector does not impair the correct operation of any other detector or call point.

Conductors shall be sized in accordance with the manufacturer's recommendations.

All cabling for detection and alarm systems shall be designed, sized and specified by the Fire Alarm Specialist. Cabling shall be carried out using a flexible fire resistant cabling system in red, zero halogen low smoke and fume sheath e.g. Pirelli Plus or Draka FT 120. All cables shall comply with the Enhanced performance requirements as detailed within BS 5839 and to meet the requirements of the fire alarm equipment manufacturers.

Generally, a flush fitting concealed installation is required in a similar manner to the lighting and power installations. In plant rooms and risers a surface installation will be acceptable.

Within accessible ceiling voids wiring shall be segregated and secured using metal fire retardant cable ties upon the common extra-low voltage cable basket (not the voice and data basket) for main distribution runs. Where wiring leaves the basket within the voids it may be clipped to the building fabric using proprietary fire-rated red coated copper cable clips, screws and rawl plugs.

Where cables drop to manual call points, sounders etc they shall be contained within surface mounted metal conduit.

All network cabling shall be designed, sized and specified by the Fire Alarm Specialist. Cabling shall be carried out using a fire resistant armoured cabling system with zero halogen low smoke and fume sheath e.g. AEI Firetec armoured Ref F1C and to meet the requirements of the fire alarm equipment manufacturers.

The Contractor shall fire stop all service penetrations throughout the building. Fire stopping shall be installed in accordance with BS 9999 Code of practice for fire safety in the design, management and use of building and in accordance with BS 476 Fire tests on building materials and structures. Fire stopping shall be installed using third party certification for the product to be used in the location installed.

The appointed Specialist shall be responsible for programming, inspecting, test and commissioning of the system and setting the system to work for Practicable Completion and for certificating the system/instillation.

The complete installation shall be inspected, tested and commissioned on completion. The Contractor shall provide confirmation through the Principal Contractor when it is considered the installation is complete and they are ready to provide all attendances and offer the installation for inspection and demonstration in the presence of the Engineer. A subsequent date shall be arranged for demonstrations of the installation and systems to the Client or their representative. Where the installations required a specialist to be appointed, the specialist shall also be available for the demonstrations.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS
Refer to 200012-SDP-XX-XX-SP-E-002 'Y' Sections for Reference Specifications.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W50.

300.000 GENERAL

300.010 TYPE OF SYSTEM:

- Standard
  - BS 5839-1.
    - Category L - Protection of life.
      - L1: system installed in all areas of the building

300.020 CONNECTION TO LOCAL AUTHORITY FIRE BRIGADE:

- PSTN
  - Grade 4C communication system.

- Link to 24/7 alarm receiving centre.
- Dual line Red care GSM roaming facility.

300.030 ZONES:

- Standard - BS 5839-1.
- Zones
  - Design extended by Fire Alarm Specialist.
- Show the location of zones by:-
  - a numbered list.
  - specially prepared plan of building, permanently mounted adjacent to the indicator panel.
  - mimic diagram permanently mounted adjacent to indicator panel.
- Zone testing
  - Provide a means of testing wiring of each zone of system.

300.040 CONTROL SYSTEM:

- Standard
  - BS 5839-6 Annex B.
  - BS EN 54-2 and BS EN 54-4.
- Analogue addressable.

300.050 EXPLOSIVE OR FLAMMABLE ATMOSPHERES:

Where fire alarm equipment or wiring are installed in areas where explosive or flammable atmospheres occur comply with BS EN 60079.

300.060 MONITORING:

Provide all end of line and other circuit elements to ensure the system is fully monitored to comply with BS 5839.

300.080 REMOVAL OF TRIGGER DEVICE:

Provide precautions against removal of trigger devices.

- Use trigger devices wired on circuits separated from manual call points.
- Route wiring so that manual call points precede trigger devices in circuit.
- Use trigger devices that are removed only by a special tool.
- Use trigger devices with bases that provide circuit continuity with trigger device removed.

Ensure that, where alarm sounders use same wiring as trigger device, removal of trigger device does not affect operation of alarm sounder.

300.100 REMOTE CENTRE:

Make provision to send signal to remote centre.

- Provide 12 month contract with an accredited 24/7 remote alarm receiving centre.
- Signals
  - Alarm – Fire alarm system.
  - Fault – Fire alarm system.
  - Fault – EVACS

300.110 FIRE ALARM SPECIALIST:

Engage a specialist to develop the design, supply, install, commission and set to work the fire alarm system.

- Specialist shall be as detailed in the Schedule of Specialist Suppliers and Materials.

310.000 PRODUCTS/MATERIALS

310.010 MANUAL CALL POINTS:

- Standard
  - BS EN 50130-4.
  - BS EN 54-11.
- Mode of operation

    - Type A.
- Indication of operation
- Protection against accidental operation
- Mounting
    - Flush.
    - Weather resistant.
    - Hinged cover.
- Switch contact
    - Make.
- Environmental Category
    - Degree of Protection to BS EN 60529
- Hazardous area
- Operation
    - MCP activation response within
        - 1 second.
        - 3 seconds.
    - Field programmable to trigger alert or evacuate alarms.
    - Test key
    - Conventional - to be interfaced to the addressable fire alarm system
    - Monitored.
    - Integral activation indicator
    - Manual operation
        - Key switch – with removal key.
    - End of line device mounted in mcp

310.020 AUTOMATIC DETECTORS

Provide automatic fire detectors from the same manufacturers and with common facilities.

- Standard - BS EN 50130-4.
- Plug in bases.
- Common base for all detector types.
- Addressable detector base.
    - 2 way.
- Mechanical device to accept only
    - Optical smoke detectors.
    - Ionisation smoke detectors.
    - Heat detectors.
    - Multi critera detectors.
- Detectors locking.
- Gated detectors
- Communicate detector status & address
- Address code setting
    - Automatic.
    - Manual.
    - Hardware
    - Software.
    - Separate addressable plug for each detector.
    - Collective addressing
- Visible activation indicator.
- Visible remote indication for detectors concealed.
- Auxiliary contact
- Label detector and bases with address number.
- Colour of devices - white
- End of line device mounted in sensor

310.030 HEAT DETECTORS:

- Type

- Point type
  - Standard
    - BS 5446-2.
    - BS EN 54-5.
- Line type
- Heat-sensitive element
  - Fixed temperature element.
  - Rate-of-rise of temperature and fixed temperature element.
  - Linear cable with temperature variable characteristics
- Types
  - Grade 1.
  - Grade 2.
  - Grade 3.
  - Grading performed by CIE software.
  - Resettable
  - Analogue addressable.
  - Conventional.
  - Combined Smoke/Heat detector
  - Combined sounder/sensor
    - Separate addresses.
    - Removal of sensor not to inhibit sounder.
- Temperature setting
  - Ambient temperature range
  - 60°C.
  - 90°C.

310.040 SMOKE DETECTORS:

- Detector type
  - Ionisation.
  - Optical.
  - Point type.
    - Standard
      - BS 5446-1.
      - BS EN 54-7.
  - Aspirating type
  - Optical beam type
    - Standard
      - BS 5839-5.
      - BS EN 54-12.
    - Optical obscuration as manufacturer requirements.
    - Thermal turbulence as manufacturer requirements.
    - Stabilisation time as manufacturer requirements.
    - Spectral range as manufacturer requirements.
    - Temperature range as manufacturer requirements.
    - Compensated for contamination of optical parts
      - End compensation alarm
    - Optical path length
    - Maximum angular misalignment
    - Dependence on CIE
    - Power supply
      - Loop powered
  - Operating wave length
  - Analogue addressable.
  - Sensitivity
    - High.
    - Normal.

        - Low.
        - Sensitivity set by CIE software.
    - Combined Smoke/Heat detector
    - Combined sensor/sounder
        - Separate addresses.
        - Removal of sensor not to inhibit sounder.
    - Environmental conditions
- Accessories
    - Line monitor device.
    - Anti-insect screens.
    - Anti-thunder fly fin structure.

310.070 SOUNDERS:

- Standard - BS EN 54-3
- Standard - BS 5839-8 Annex
- Sounder types
    - Electronic sounder.
    - Addressable.
    - Combined sensor/sounder
        - Separate addresses.
- Sounder characteristics
    - Unique sound signature
        - Fire.
        - Lockdown.
        - Class change.
    - Sound power output (dBA) as manufacturers standard.
- Colour
    - Fire red.
    - White.
- Finish
    - Protection to BS EN 60529
    - Weather proof – external.
    - Internal.
- Sounder accessories
    - Sounder driver
        - Monitored
        - Addressable
        - Activation indicator.
    - Sounder booster
        - Input
            - CIE sounder output.
            - Sounder driver output.
            - Monitored
            - Addressable
    - Sounder power supply
        - Monitored.
        - Addressable.

310.080 FIRE ALARM CONTROL AND INDICATING EQUIPMENT:

- Standard
    - BS 5839-1.
    - BS 5839-6 Annex B.
    - BS EN 54-2 and BS EN 54-4.
    - BS EN 50130-4.
- Functional requirements

    Standard functions.

    - operation of other functions.
    - battery state indicator .
    - battery reverse polarity protection.
- Mounting
    - Surface.
- Assembly Construction
    - Material of Enclosure as manufacture standard.
    - Display components
        - Mounted on hinged front cover.
        - Behind hinged front panel.
- Degree of Protection to BS EN 60529
    - IP 43.
- Accessibility
    - By special tool
- Enclosure Finish
- Colour to manufacturers standard
- Power supply
    - Integral.
    - Separate
- Indication of origin of alarms
    Zone indication
        - Integral with CIE
        - Separate panel where necessary.
        - Alphanumeric display to manufacturers standard.
        - Permanent mimic diagram
        - Printer
            - Panel mounted.
- General
    - Microprocessor based
    - Modular software
        - Deadlock prevention
    - Execution monitoring
        - 1 hour cycle.
    - Execution failure safe state
    - One man test and commissioning
    - Monitoring circuit.
    - Configuration data.
        - Non-volatile memory.
        - Volatile memory.
        - Alterable memory.
            - Programmable at
                - Level 1
                - Level 2
            - Manual action at Level 3 before data change
            - Automatic check
                - 1 hour
                - 24 hours
        - EEPROM.
        - Read/write memory programming protection
        - Battery backed.
            - ROM.
            - RAM.
    - Real time clock
    - Configuration updates performed on site.
    - Configuration data copied on to floppy disc
    - Document control system for configuration data

- System fault protection
    - No more than 512 detectors affected by first fault
- Maximum addressable points controlled by a single processor.
    - 200.
- Key switch, positions
    - Normal, key free Level 1.
    - Normal, key trapped Level 1.
    - Enable Level 2.
    - Test display.
    - Scroll.
    - Silence.
    - Sound alarm.
    - Sound alert.
    - Reset.
- Remote inputs to CIE
    - Evacuate.
    - Silence Alarm.
    - Reset.
    - Alert.
    - Class change.
    - Programmable
- System Configuration
    - Capable of operating
        - Analogue addressable detectors.
    - Division of addressable loops into zones
    - One fault not to disable more than 32 detectors.
    - Capacity of addressable loop
        - Zones
        - Minimum 99 devices.
        - Maximum
            - Sensors and mcp
    - Fault protection by line isolators.
        - At zone boundaries.
        - At each addressable device.
        - At each addressable sensor.
        - Design to be extended by Fire Alarm Specialist.
    - Line isolator operation time.
        - Within 2 seconds of fault.
    - Allocation of addresses independent of physical arrangement of loops.
    - Distributed CIE
- Interfacing
    - Other CIE/systems
    - Standardise input/output interface for fire brigade panel
- Basic System Functions
    - Monitor status
        - All devices on addressable loops.
        - Conventional MCP on zone monitors.
        - Short circuit and Open circuit faults.
        - Incorrect addressing.
        - Unauthorised device removal or exchange.
        - Pre alarm condition.
        - Detector contamination.
        - Internal connections.
        - Interfaces.
        - Chargers.
        - Battery.

        - Remote signalling.
        - EVACS.
    - Audible indication
    - Visual Indicator Lamps
        - Power on - Green.
        - Quiescent condition
        - Fire Alarm - Red.
        - Fault Warning - Yellow.
        - Disabled/Isolated - Yellow.
        - Fire zones - Red per zone.
        - Test condition - Yellow.
        - Output to fire alarm routing equipment - Red.
        - Output to fire protection equipment - Red.
        - Output to fault warning routing equipment - Yellow.
        - Flashing
        - Steady
    - Push Button or Switch Controls
        - Sound Alarms/Evacuate.
        - Silence Alarm
            - Audible signal if not reset.
        - Silence Control Sounder.
        - Test Alarms.
        - Reset fire.
            - Level 1.
            - Combined with control sounder silence at Level 2.
        - Lamp Test.
        - Cancel Fault Buzzer.
        - Keypad.
        - QWERTY keyboard and function keys
    - Access, levels
        - Level 1 - No restriction.
        - Level 2 - Operator
            - By key.
            - By code
        - Level 3 - Servicing
            - By key.
            - By code
        - Level 4 - Engineering
            - External device
    - Zone status indicators
        - Alarm.
        - Fault.
        - Isolated.
- Alarm Monitoring Functions
    - Interrogate addressable devices
        - Order of scanning
        - Every 2 seconds maximum.
    - Analysis of sensor output against fire algorithms to differentiate between
        - Fire conditions.
        - Pre-fire conditions.
        - Super-fire conditions
        - Multiple fire conditions
        - Coincidence detection
        - Transient contamination
        - Permanent contamination
        - Sensor condition.

        - Non-fire events
    - Indication of alarm for any detectors not to exceed 10 seconds, with output not more than 2 seconds later.
    - Response to mcp activation
        - 1 second.
        - 3 seconds.
    - Time zoning
    - Alarm sectoring
- Alarm Output Functions
    - Two monitored sounder circuits. Output (A)
    - Two stage programmable alarm sounder
    - Logic outputs
    - Audible indication of alarm
        - Silenced at Level 1.
        - Silenced at Level 2.
    - Alarm reset
    - Alarm output silence
    - Output to fire protection equipment
    - Disable warning at Level 3
    - Sound outputs
        - Evacuate continuous tone.
        - Class change
        - Special event
            - School lockdown
    - Voice alarm units
    - Delay sounder output
        - Delay override
    - Delay transmission to central station for,
        - 2 minutes.
        - Inhibit delay if building unoccupied.
        - No delay on activation of manual call point.
- Supervision and Fault Reporting
    - Faults to be reported
        - Short circuit and Open circuit
            - Loops.
            - Sounder cables.
            - Conventional detector circuits.
            - MCP circuits.
            - Ancillary devices circuits.
            - Voice alarm system.
            - Repeat or Secondary indicators.
        - Unconfigured device.
        - Addressable device failure.
        - Device not responding.
        - Double address.
        - Incorrectly configured device.
        - Detector condition.
        - Detector removed.
        - Sounder condition
        - Repeater or Remote printer failure.
        - Repeat or Secondary indicators fault.
        - Earth fault
        - Main Power fault.
        - Standby Power fault.
        - PSU fault.
        - Charger fault.

        - Battery fault.
        - Battery critical.
        - Mains failure.
        - Auxiliary PSU failure.
        - Total loss of power
        - Fuse failure.
        - Relay Output fault.
        - System fault
        - Signalling fault.
        - Scanning or interrogation failure.
        - Processor failure.
        - Memory check error.
        - Memory configuration data loss.
        - Processor failure
            - Re-initialise, record and reset.
            - Re-initialise, reset and indicate fault.
        - Transmission in path fault
    - Fault sounder
    - Fault indicator
        - Silence fault warning
            - Level 2.
            - Level 1.
        - Reset
            - Automatic.
            - Manual
        - Fault output
            - On de-energising
            - Suppress during fire
    - Zone fault indicator
    - Test message to define and locate fault.
    - Monitor status of auxiliary units
    - Fault response time
        - Less than 100 sec.
    - Processor fault count
    - Auxiliary fault output
    - Delay generation of event
        - Normal de-bounced contacts 6 seconds.
        - Fluctuating contacts (e.g. sprinkler valve flow switches) 40 seconds.
- System Management System, available at Levels as required by BS EN 54-2.
    - Management Facilities
        - Isolate and re-connect.
            - Addressable point.
            - Detector zone.
            - Sounder zone.
            - Remote centre signalling.
        - Walk-test of zones to verify detectors and sounders.
        - Interrogate sensor
            - Cleanliness.
            - Condition.
        - Display on alphanumeric display via menu system.
            - Alarm status
                - Alarm log
                - First zone alarm top field
                - Most recent zone alarm
                - Total number of alarms
                - Alarm scrolling

        - Alarm display reversion
    - Output to fire alarm routing equipment
    - Suppression of non-alarm displays
        - Action to display non-alarm information
        - Non-alarm reversion time
    - System events
        - Event log.
        - Event log capacity.
    - Analysis of sensor data
    - Interrogation of sensor cleanliness
    - Loop map connections.
    - Enabled and disabled sensors.
    - Fire plan configuration.
    - Address locations.
    - Initialisation log
    - Fault status
        - Fault log.
        - Fault indication suppression override
        - Disablement
    - Point isolated status.
    - Zone isolated status
    - Point address status
        - Address displayed/printed
            - As numerals
            - As alphanumeric code
    - Non-fire event status
        - Non-fire log.
    - Zone alarm status.
    - Zone fault status.
    - Clear display function for non-fire events.
    - Cycle or scroll display
- Print, via menu system
    - Alarm status
        - Alarm log.
    - System events
        - Event log.
        - Event log capacity
    - Current fault and warning logs
    - Analysis of sensor data
    - Interrogation of sensor cleanliness
    - Loop map connections.
    - Enabled and disabled sensors.
    - Fire plan configuration.
    - Address locations.
    - Initialisation log
    - Fault status
        - Fault log.
    - Point isolated status.
    - Zone isolated status
    - Point address status
        - Address displayed/printed
            - As numerals
            - As alphanumeric code
    - Non-fire event status
        - Non-fire log
- Weekly system audible and visible warning test (BS 5839-1).

- Disable/re-enable at level 2
    - Zone
    - Fire detection equipment output
    - Fault warning routing equipment.
    - Sounder.
    - Fire alarm routing equipment.
    - Addressable points
- Isolated devices reset after pre-set time
- Co-incidence detection setting zone by zone
- Real time clock adjustment
- Event counter
    - Manual display
    - Automatic display
- Test facilities
- Memory check
    - Manual
    - Automatic
        - Cycle 7 days or less
- Site configuration updating
    - Loop map connections
    - Addressable device label change.
    - Address allocation.
- Division of addressable loops into zones
- CIE programmable
    - Executable code and mandatory data at Level 4.
    - On site.
    - With integral keyboard.
    - By separate computer
    - Software documentation
- Communications with remote centre
    - Signals
        - Alarm.
        - Fault.
        - Zone indications.
- Communications link
    - RS 232
    - RS 485
- CIE Networking
    - Master Terminals
    - Graphics Terminals
    - Remote printers
    - Modem connections

310.110 ANCILLARY SERVICES:

Make provision to open or close circuits of ancillary services by means of relay or similar device.

- Standard
    - BS EN 54-2.
    - BS EN 50130-4.
- Services
    -
    - Actuation of fixed fire-extinguishing systems.
    - Closing of windows, smoke and fire doors.
    - Controlling ventilating systems.
    - Emergency lighting
- Relay type
    - Addressable

    - Output
        - Volt free contacts, rated
    - Monitored.
    - Power from addressable loop.
    - Activation indicator
- Input
    - Monitored
    - Addressable
    - Keyswitch for sensor disable
    - Firemans switch
    - From CIE.
    - From detectors
    - From mcp
    - Non-fire
- Activation indicator
- Output
    - Monitored.
    - PA.
    - BMS.
    - Door holder.
    - Plant
    - Non-fire
    - Contacts

310.120 POWER SUPPLIES:

- Type
- Application
- Manufacturer and reference
    - Or approved equivalent
- Standard
    - BS 5839-1.
    - BS EN 54-4.
    - BS EN 50130-4.
- Power supply enclosure
    - Degree of protection to BS EN 60524
        - IP30.
    - Separate cabinet.
    - Integral with CIE.
    - Access to controls
        - Level 3 if integral.
        - Tool.
        - Key.
- Connection to CIE
    - Two transmission paths.
- Normal power supply
    - Public supply system.
    - Primary battery
- Standby supply.
    - Provide standby power supplies in accordance with BS 5839-1and BS EN 54-4.
        - Secondary battery
        - Automatically started emergency generator
- Standby battery type
- Charger
    - Battery monitoring
- Power supply fault signalling to CIE
    - Common fault signal

    - Loss of main power
    - Loss of standby power source
    - Low battery voltage
    - Charger fault
- Fault indication on pse
- Duration of standby supply
    - Secondary battery
    - Normal supply primary battery
    - Standby supply primary battery
- Standby battery recharge time
    - To 80% 24 hours.
- Battery accommodation

310.130 REMOTE INDICATOR MODULE

- Standard
    - BS EN 54-2.
    - BS EN 50130-4.
- Driven by its associated detector.
- Monitored for open and short circuits.

310.140 LINE ISOLATOR MODULE

- Standard
    - BS EN 54-2.
    - BS EN 50130-4.
- Derive power from addressable loop.
- Visible LED indicator that module has tripped.
- Maximum of 15 devices per short circuit device.
- Maximum of 7 units per loop.

310.150 VISIBLE ALARMS:

- Standard
    - BS EN 54-2.
    - BS EN 50130-4.
- Audio visual alarm unit
- Flashing.
- High power LED.

310.160 ZONE MONITORING UNIT:

- Standard
    - BS EN 54-2.
    - BS EN 50130-4.
- Characteristics
    - Addressable.
    - Monitored.
    - Reports faults and alarms to CIE.
- Facilities
    - MCP
    - Remote indication units
    - Remote test facility
    - Power for detectors
    - Line isolator
    - Zener barrier
    - Monitor relays
    - Address setting by rotary switch
- Power supply
    - Integral

- Separate

310.170 AUTOMATIC RELEASE MECHANISM:

- Standard
  - BS 5839-3.
  - BS EN 50130-4.
- Type and Characteristics
  - Door holder
    - Door closer
      - Mounting
        - Overhead.
        - Pull side.
        - Push side.
  - Automatic operation
  - Manual operation
  - Operation by CIE signal
  - Electromagnetic
  - Nominal holding force
  - Residual force
  - Power supply
    - a.c.
    - 24V.
    - 240V.
  - Mounting
    - Wall.
    - Floor.

320.000 WORKMANSHIP

320.010 QUALITY CONTROL:

Handle, store and install equipment and components of the fire detection and alarm system in accordance with BS 5839 and the manufacturer's recommendations.

- Obtain all equipment and components from a single source.

Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.

Record all commissioning tests and provide the certification required by BS 5839-1.

- Provide manufacturer's certificates of equipment design to an approved quality management system and CIE component selection.

320.015 EQUIPMENT FIXING DETAIL DRAWINGS:

- Heat detector in concrete ceiling, standard detail E685EFS006.
- Heat detector on plasterboard ceiling, standard detail E685EFS005.

320.030 MANUAL CALL POINTS:

- Where manual call points are sited in zones.
  - Wire into detector circuit for fire zone.
  - Wire into separate circuits to conform with detector zones.
- Wire manual call points sited on staircase landings
  - as a separate zone.

320.040 RECORD DRAWINGS AND OPERATING INSTRUCTIONS:

Provide instructions on use of installation to person responsible for use of premises. Supply the user with a logbook and certificate of installation and commissioning, in accordance with BS 5839-1, Appendix B and D.

Provide record drawings to user for maintenance and record purposes.

Show position of various items of equipment, junction boxes, etc.and sizes and routes of cables and wires. Include wiring diagrams of junction boxes and distribution cases.

- Provide circuit diagrams of fire alarm system and its components and detection and alarm zone drawings.

320.050 CABLE INSTALLATION:

The Fire Alarm Specialist shall extend the design, plan and install all fire detection and alarm system cables in accordance with BS 5839-1 and the cable manufacturer's recommendations.

- Run cables point to point without tees or spurs.
- Design loop load and connection capacity to not exceed 80% of cable capacity.
- Mark terminals

W53 LV EARTHING AND BONDING

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
To provide a complete earthing, main protective bonding and supplementary protective bonding installations to provide protection under automatic disconnection of the supply and to minimize the magnitude of touch voltages between exposed and extraneous conduct parts throughout the building.

100.020 STANDARDS:
The complete design, installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- Health and Safety at Work Act.
- Health and Safety at Work Regulations.
- The Electricity at Work Regulations.
- The Electricity Safety, Quality and Continuity Regulations.
- District Network Operator - Conditions for Connection Works & Protection.
- BS7671 – The Requirements for Electrical Installations (18th Edition).
- BS7430 – Code of practice of Protective Earthing for Electrical Installations.

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 SYSTEM DESCRIPTION:
The Contractor shall be responsible for the supply and installation of a complete earthing installation for the electrical installation within the building in accordance with this specification, including the inspection, testing and commissioning of the installation.

Electrical car charger specialist shall be responsible for the design, supply and installation of the earthing installation for the charging stations to comply with current IET Wiring Regulations

The Contractor shall be responsible for installing all necessary including but not be limited to the following:-

- Main earth bars within the Electrical Intake room.
- Earth bar for the Server room.

Earth bars shall consist of 6mm x 50mm, hard drawn copper bars and be provided with at least 25% spare capacity once all connections have been made. All earth bars shall be complete with removable test links to allow separate testing of the external earth loop impedance.

The main earth bar within the Electrical Intake room shall include connections to the, plant room earth bars, lightning protection system and main equipotential earth bonding.

Server room earth bar shall include connections to cabinets and ceiling grids and any extraneous conductive parts within each room.

Main protective equipotential bonding conductors shall be provided in accordance with BS7671 to minimise the magnitude of touch voltages appearing within the building when and earth fault occurs in the installation, which shall include but not be limited to the following:-

- Incoming water.
- Incoming gas.
- Lightning protection system.
- Lift guide rails.
- Heating pipes.
- Hot and cold water services.
- Ventilation ductwork.

- Primary cable containment systems.

Main protective equipotential bonding connections shall be made within 600mm of a service entering the building, or within 600mm of the origin of the service.
All main equipotential bonding conductors shall be provided with an engraved traffolyte label located below the cable lug and fixed in a secure manner.

Supplementary protective equipotential bonding shall be installed in addition to the fault protection required in BS7671 to minimise touch voltages appearing between exposed conductive parts and extraneous conductive parts. Supplementary bonding shall be carried out in accordance with the requirements of BS 7671. This shall include but not be limited to the following:-

Wash hand basins, including the interconnections to hot and cold taps and metal waste pipes.
Sink units with stainless steel drainer shall have their hot and cold taps, drainer and metal waste pipe bonded.

All supplementary bonding shall be connected to the building's main earth terminal using a direct connection to the building electrical earthing installation by taking the bonding cable back to a local circuit earth connection a suitable accessory position.

Where supplementary bonding points are located below ceilings, a flush flex outlet plate mounted adjacent to the exposed or extraneous conductive part shall be provided. Earth flex outlet plates shall be coordinated to coincide with the exposed or extraneous pipe work, appliance, equipment etc being bonded.

All supplementary protective bonding and cross bonding conductors shall not be less than 4mm².

Circuit protective conductors shall be installed for all circuits, taken from the earth bar within the appropriate distribution boards and sized in accordance with BS7671. Conduits, trunking, cable tray and cable baskets shall not be used as a circuit protective conductor.

All socket outlets radial and ring-main circuits shall be designed with high integrity earthing. Radial circuits shall be provided with two circuit protective conductors each sized in accordance with Section 543 of the IET Wiring Regulations.

Earthing shall be provided for all transient voltage surge protection devices in accordance with the Lighting Protection Specialist requirements.

Electrical car charger specialist shall be responsible for the design, supply and installation of the earthing installation for the charging point to comply with current IET Wiring Regulations.

The complete installation shall be inspected, tested and commissioned on completion. The Contractor shall provide confirmation through the Principal Contractor when it is considered the installation is complete and they are ready to provide all attendances and offer the installation for inspection and demonstration in the presence of the Engineer. A subsequent date shall be arranged for demonstrations of the installation and systems to the Client or their representative. Where the installations required a specialist to be appointed, the specialist shall also be available for the demonstrations.

PART 2 SELECTION SPECIFICATION FOR REFERENCE SPECIFICATION
Refer to 200012-XX-XX-SP-E-002 'Y Sections' for reference specifications.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W53

300.000 GENERAL

300.010 STANDARDS:
• Carry out the installation, inspection and testing of an earthing and bonding system for the low voltage electrical installation in accordance with Electricity Safety, Quality and Continuity Regulations,

Electricity at Work Regulations 1989, BS 7671, BS 7430 and local Distribution Network Operator (DNO) requirements.
- Confirm with the DNO that, in the event of a fault in the high voltage network, the resulting transfer Earth Potential Rise (EPR) to the low voltage electrical installation can be achieved at a safe level. If the safe level cannot be met, control measures should be provided to eliminate risk of injury.
- Ensure the potential rise in telecommunications circuits due to power system earth faults is limited, as per BS 6701
- For functional requirements of information technology and telecommunication systems, to be installed within the building (now or in the future), see BS EN 50174-1, BS EN 50174-2 or BS EN 50174-3 and BS EN 50310.
- Ensuring that the integrity of the structural steelwork will not be subject to any detrimental influences by any stray DC current flowing in the earthing and bonding system or suitable measures have been taken to avoid it.

300.032 COMMON BONDING NETWORK:
- Where appropriate, form a Common Bonding Network for information technology equipment by equipotential bonding of metalwork throughout the building. Carry out work to the Common Bonding Network in accordance with BS 7671, BS EN 50174-1, BS EN 50174-2 or BS EN 50174-3 and BS EN 50310. Include in the CBN but not limited to
  - Steel structural frames.
  - Reinforcement bars in concrete.
  - Metallic roof coverings.
  - Ceiling grids.
  - Services
    - Railway and crane rails.
    - Dry risers.
    - Water services.
    - Air ductlines.
    - Gas services.
  - Power cable containment

300.034 USE OF BUILDING ELEMENTS:
- Ensure that building and structural elements used as items in or bonded to the Common Bonding Network are designed and erected in accordance with BS EN 50174-1, BS EN 50174-2 or BS EN 50174-3 and BS EN 50310 as well as their appropriate constructional specification or code of practice. Ensure that all connections to building and structural elements are waterproof and corrosion protected to a degree appropriate to their exposure. A risk assessment on detrimental influence in weather and corrosion protection would be required.

300.040 EXISTING INSTALLATIONS:
- Check and verify earth continuity conductors and loop impedance values of existing installation. Report defects and elements not in accordance with BS 7671 before connecting new or modified installations to existing supply or a new supply.

300.050 SOIL TESTS:
- Carry out soil tests in accordance with BS 1377 to establish soil characteristics
  - pH.
  - Redox potential (V).
  - Moisture content (%).
  - Dissolved salts
    - Chloride.
  - Organic acids.
- Apply one or more acceptable industry practice testing method to carry out soil resistivity tests in accordance with the requirements of BS 7430.
- Obtain a multilayer soil model.

300.060 RISE IN POTENTIAL IN TELECOMMUNICATIONS:

- Ensure the potential rise in telecommunications circuits due to power system earth faults is limited as BS 6701

300.070 EXCHANGE OF INFORMATION:
- Consult with the local DNO regarding the earthing arrangements of the installation. Construct the earthing system to the requirements of BS 7430 and BS 7671. Ensure any part of the earth fault current path provided by the DNO or others is suitable for the operation of the earth fault protection to be installed. Obtain the agreement and permission of undertakings providing services which are to be bonded to the earthing system.

310.000 PRODUCTS/MATERIALS

310.020 MAIN EARTHING TERMINAL:
- Provide a Main Earthing Terminal (MET) in the form of a main earth bar at incoming electrical service position, connecting to each switchboard.
- Bond earth terminals and metallic structure of switchboards and control panels and plants.
- Connect each earth bar to all other earth terminals, between switchboards or control panels, by a suitable protective conductor sized as per BS 7671.
- Location
  - Adjacent to main LV switch panel.
- Mounting
  - Mount earth bar on insulated supports located at 300mm centres for 25mm bar and 450mm centres for 50mm bar, giving 30mm clearance at rear of bar.
- Drill clearance holes, one for each cable plus 30% spare holes (2 minimum) at 50mm minimum centres through bar for connection of cable lugs. Ensure clearance holes are minimum necessary size to maintain adequate lug/bar contact.
- Size the MET and protective earthing conductors in accordance with BS 7671

310.030 MAIN EARTH TERMINAL CONNECTIONS:
- Connect main earth conductors and main equipotential bonding conductors to main earth terminals.
- Terminate circuit protective conductors on switchboard and control panels earthing bar.
- Terminate conductors with
  - Compression type lugs suitable for bolting direct to bar.
- Extend protective conductor from incoming main cable gland direct to main earth terminal.
- Extend separate protective conductor from main earth terminal to main switch/switch panel served by incoming main cable.
- When the mains supply cable is provided by the DNO, extend separate protective conductor from Mains Supply Cable armouring gland or direct earth terminals or PME earth installed by the DNO to the main earth terminal.
- Bond all main equipment and plant to an earth terminal, connected to the bonding ring or radial conductor(s).
- Connect telecommunications and data equipment in accordance with BS 6701.
- Where appropriate, provide torque record of the bonding connections.

310.070 LOW NOISE EARTH BAR:
- Location
  - Main LV switch room.
- Mounting
  - Mount earth bar on insulated supports located at 300mm centres for 25mm bar and 450mm centres for 50mm bar, giving 50mm clearance at rear of bar.
- Insulators
  - Mount busbar on
    - Stand-off porcelain insulators securely fixed to wall.
    - Impact resistant moulded plastic.
- Terminations
  - Connect each conductor and tape separately and allow spare holes (minimum 2) for future connections.

- Connect telecommunications and data equipment in accordance with BS 6701.

310.090 INSULATED ISLAND GLANDS:
- On cables to switchboards provide insulated island glands to facilitate testing.

310.100 MICS CABLE TERMINATIONS:
- Provide manufacturer's seals incorporating protective conductors at each termination, where glands are used or not, and connect conductors to conduit box, adaptable box or equipment box earth terminals.

310.110 FRAME EARTH LEAKAGE:
- Where frame earth leakage devices are used for phase to earth protection, connect 2 earthing conductors as per BS 7430, one to the framework of the switchgear and main earth bar via current transformer or other devices, the other to cable sheaths and earthing devices, insulated where necessary.

310.120 PORTABLE EARTH CONNECTIONS:
- Provide tape loops for the connection of portable earths

310.130 CEILING SUPPORTS:
- Bond main supports to exposed conductive parts of electrical installation where appropriate (based on risk assessment).
- Conductor
- Use LSF insulated copper cable
- Holes
  - Drill or punch holes in main supports in positions indicated to receive terminal screws.
  - Use holes in main supports for terminal screws.
- Terminals
  - Connect bonding conductors to supports through holes with tinned copper cable lugs or tags secured to support with brass screws, washers, nuts and locking device.
- Connection
  - Connect bonding conductors to supplementary bonding conductors in cable trunking:
  - Using crimp type connectors.
- Include ceiling supports in CBN.

310.140 SAFETY EARTHING:
- Provide safety earthing in accordance with BS 6626 and HSE guides INDG872 and HSG230.
- Earthing switches
- Integral earthing in circuit breakers
- Provide portable earthing leads

310.150 TELECOMMUNICATIONS FUNCTIONAL EARTH:
- Provide functional earth in accordance with BS 6701 and BS EN 50310.

320.000 WORKMANSHIP

320.010 INSTALLATION OF LV AND FUNCTIONAL EARTHING SYSTEM:
- Carry out installation of earthing system in accordance with BS 7430, BS 7671 and BS EN 50310.

320.020 WORK ONSITE
- Ensure that all building works are completed and service connections are provided,
  - By others.

320.030 QUALITY CONTROL:
- Handle, store and install all equipment and components of the lightning protection system in accordance with the manufacturer's recommendations and
  - BS 7430

- BS 7671
- BS EN 50310

- Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
- Test and commission the system in accordance with BS 7671 and BS EN 50310 as specified.
- Record all test measurements.

320.040 EQUIPOTENTIAL BONDING:

- Bond to main earth terminal all extraneous-conductive-parts of the installation in accordance with
  - BS 7430.
  - BS 7671.
  - BS EN 50174.
  - BS EN 50310.
  - BS EN 62305.
- Ensure the following services are bonded
  - Structured steel
  - Concrete steel reinforcement
  - Metallic ceiling grids.
  - Main gas pipes.
  - Fuel oil pipes.
  - Air ductlines.
  - Heating pipework.
  - Chilled water pipework.
  - Exposed metallic parts of building structure.
  - Thermal insulation metallic cladding.
  - Metallic cable sheaths of all cables except British Telecom.
  - Lightning protection systems.
  - Others
- Bond with supplementary equipotential bonds to protective conductor system, all simultaneously-accessible exposed-conductive-parts and extraneous-conductive-parts.
- Ensure the following areas are bonded to BS 7671, Section 701
  - Bathrooms and shower rooms.
- Bond to non-current carrying parts of electrical installation in associated spaces to BS 7430.
- Use clamps to BS 951 for bonding of pipes.

320.060 LOW VOLTAGE SHEATHS AND ARMOUR:

- Bond the sheaths and armour of low voltage cables solidly to earth in accordance with BS 7671 and BS 7430.
  - 3 core cables, at both ends.
  - Single core cables
    - At both ends (the derated current carrying capacity of the cable to be provided).
    - Single point, with separate circuit protective conductors (the maximum induced voltage of the cable to be provided).

320.070 METALLIC FENCING:

- Bond to earth any metallic fencing enclosing the LV electrical earthing system in accordance with BS 7430.
- Fence earthed separately
- Fence earthed to the LV earthing system

320.080 IDENTIFICATION:

- Ensure the function of each protective and functional earthing and bonding conductor is identifiable at its termination points.
  - Use an appropriate cable marking system, to mark conductors in accordance with the cable schedule.
- For circuit protective conductors:

- Use numbered and/or lettered plastic cable sleeves to indicate circuit numbers and phases of corresponding phase conductors.
- Ensure conductors are connected to earth bar in same sequence as phase and neutral conductors.

- Identify at substation, switchboard and building earth bars each protective, bonding and earthing conductor. Provide labels on bars adjacent to each conductor to appropriately identify the function of the conductor.

320.160 EARTHING OF ELECTRICALLY SUPPLIED STREET FURNITURE:

- Install earthing to street furniture in accordance with BS 7671 (IET Wiring Regulations) and BS 7430.
- TN-S systems.
  - Use cable with separate phase neutral and protective conductors to supply street furniture.
  - Ensure on the load side of the protective device separate phase, neutral and protective conductors are used.
  - Bond conductive parts of the street furniture to the earthing terminal within the equipment. Connect the street furniture incoming supply protective conductor to the same earthing terminal.
- TN-C-S / PME systems.
  - Comply with the latest version of Energy Networks Association (ENA) Engineering Recommendation G12 "Requirements for the Application of Protective Multiple Earthing to Low Voltage Networks".
  - Use cables with separate neutral and earth for private installations and where specified for Local Authority installations.
  - Do not bond small items not likely to come into contact with exposed or extraneous conductive parts or earth.
  - On circuits feeding more than one item of street furniture, provide an earth electrode of 20ohm or less resistance at the last or penultimate item of furniture on the circuit.
  - Where an electrode resistance of 20ohm cannot be achieved, provide earth electrodes at each item of furniture.

320.170 EARTHING OF ELECTRICAL SYSTEMS IN HAZARDOUS AREAS:

- Install earthing of electrical systems in hazardous areas to BS 7671 (IET Wiring Regulations), BS 7430 and relevant parts of BS EN IEC 60079 / BS EN 60079. Use the recommendations in APEA Design, Construction and Modification, Maintenance and Decommissioning of Filling Stations (fourth edition), at petrol filling stations.
- Use the recommendations in APEA Design, Construction and Modification, Maintenance and Decommissioning of Filling Stations (fourth edition), in hazardous areas.

320.190 EARTHING OF PHOTOVOLTAIC (PV) SYSTEMS:

- Earth PV electrical systems to BS 7671, Section 712.

W70 STRUCTURED CABLING SYSTEM

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:

To provide a complete and fully functional structured cabling system to support data and voice transmission throughout the building.

100.020 STANDARDS:

The complete design, installation, equipment and components shall be selected, manufactured and installed in compliance with British statutory requirements, regulations, standard specifications and codes of practice, in particular with the current edition of:

- Health and Safety at Work Act.
- Health and Safety at Work Regulations.
- The Electricity at Work Regulations.
- The Electricity Safety, Quality and Continuity Regulations.
- BS7671 – The Requirements for Electrical Installations (18th Edition).
- BS7430 – Code of practice of Protective Earthing for Electrical Installations.
- BS EN 50173 (Parts 1 to 6) – Generic cabling systems.
- BS EN 50174 – Information Technology.
- National Joint Utilities Group Guidelines.
- ESFA - Output Specification, Generic Design Brief, Version 10 (Nov 17).
- ESFA – Technical Annex 1 to 4 (Nov 17).
- ESFA – Appendix A ICT Strategy and Requirements & ICT Input to the School Specific Brief.

Ensure all materials, equipment and components are installed fully in accordance with the manufacturers written installation instructions and requirements.

100.030 STRUCTURED CABLING - SYSTEM DESCRIPTION:

The Contractor shall extend the design, supply and install a new fully functional data transmission and structure cabling system in accordance with this specification and accompanying drawings.

The Contractor shall appoint an approved ICT Specialist to design, supply, install, test, commission and certificate the data transmission and structured cabling works. The cabling installation shall be complete with a 20 year end to end system warranty.

Within the server room equipment cabinet shall be provided and include new 10 GbE switches and patch panels as required for a complete and fully functional installation. To simplify access between systems and minimise spares, a common type of managed switch will be used across voice, data and security systems. It is expected that these switches will support power over Ethernet (PoE).

Cabinet shall be manufactured from steel, fitted with two mounting frames to facilitate shelf and equipment mounting. Cabinets shall be complete with a vented front / rear door fitted with handle and lock and incorporate a plinth. The rear and sides of the enclosure shall have removable lockable steel panels, complete with documentation wallet. All cabinet keys shall be identical. Wall. Fan trays shall be provided within the cabinet housing the server.

Cabinets shall be positioned within the rooms/spaces to ensure a 1200mm clear area is marinated at the front and rear of the cabinet for access where possible.

The cabinets shall be provided with power distribution units and connecting leads/plugs to supply all equipment within the cabinets. PDU shall generally comprise:

Server Cabinet:

- 3pin 13A BS1363 outlets with on/off switch PDU and C20 plug.
- 10A IEC 60320 C13 socket outlets with on/off switch PDU and C20 plug.
- 10A IEC 60320 C13 socket with circuit breaker PDU + IEC 60309 plug.

- 32A IEC 60309 SP&N plug and lead for UPS supply.

Individual supplementary bonding links shall be provided from the earth bar to each demountable panel and door.

All passive equipment within the cabinet shall be supplied and installed by the ICT Specialist and shall generally comprise, but not be limited to the following:

- Patch panels (fibre).
- Patch panels (structured cabling).
- Blanking plates.
- Cable tidy's.
- Patching leads (fibre).
- Patching leads (structured cabling).

All active equipment within the cabinet shall be supplied and installed by the colleges ICT Specialist, generally comprising, but not limited to the following:

- UPS's
- Server.
- Core Switches.
- Edge Switches.
- POE Switches.
- VOIP equipment.
- IPTV equipment.

The final connection of active equipment to the passive installation shall be carried out by the colleges ICT Specialist.

Fibre cabling shall be drawn through cable ducts linking between buildings. Where fibre cables serve a common building, they shall be drawn through individual cable ducts within a common services trench with the cable ducts separated from one another by a minimum distance of 800mm.

Each optical fibre link shall include 16 core multi-mode OM4 (50/125) LS0H fibre cable and be provided from a single cable manufacturer.

A structured cabling system shall be provided to throughout the building connecting to data outlets serving ICT equipment, multi-media devices, voice and to support engineering services/systems. The structured cabling system shall comprise an all copper Cat 6A UTP having a maximum data transmission speed of 10,000Mbps and maximum 500MHz All cabling shall have a Caa-S1a, d1,a1 Euro class rating. All cabling shall be supplied from a single cable manufacturer.

Cabling shall be fully support throughout its light using heavy duty cable baskets and conduits as detailed within section V21 Containment Systems within this specification. Cable drops to accessories shall be surface mounted galvanised conduit shall be installed on fair face block work walls. Metal trunking shall be used to contain cabling on teaching walls. At no point shall communications cables be tied to power cables or run along the same conduits or ducts, or run through the same connection box.

All cabling shall be secured to the cable trays using Velcro stapes, or other fixing method approved by the cable manufacturer.

Single or double RJ45 Cat 6A data outlets shall be installed, mounted within a modular snap in frame. Each RJ45 outlet shall be labelled with the corresponding reference as the cable connected to it.

Cables shall be neatly cable tied and dressed inside back-boxes. Sufficient slack cable shall be allowed on each connector to enable the faceplate to be unscrewed and removed for visual examination or repair, and to allow replacement of connectors at a future date.

Care shall be taken not to exceed the minimum recommended bending radius or cables within back boxes or within containment systems.

Appropriate protective glands, grommets, boots and sleeves shall be installed and securely fixed at entry points to back-boxes.

Cables shall be secured or tied to ensure that strain is not transferred to electrical contacts, and that inspection of connectors imposes no movement or strain on individual cable pairs and their terminations. Strain relief shall not damage cable jackets or conductors. Strain relief shall be inherent within connectors or separately mounted.

Adequate data cable provision and final outlets shall be provided throughout the building to support the colleges wireless access network. Prior to the structured cabling installation commencing, the Contractor shall obtain confirmation on the suitability of the locations for data outlets serving wireless access points from the Schools ICT Specialist.

The structured cabling system shall be used to support the data transmission of the schools IP based closed circuit television system (CCTV). The ICT Specialist shall provide all patch panels, structured cabling, data outlets, patching leads and patching of cameras to network video recorders as necessary to provide a full functional cabling system. A monitor and separate keyboard shelf shall be provided within the server cabinet in server room for use by the CCTV Specialist.

Accessories shall generally be plastic finish except in plant rooms/spaces where metal clad type accessories shall be used. Ingress protection rated accessories shall be used externally or in areas where the environmental conditions require.

Further information is detailed within the Schedule of Specialist Suppliers, Manufactures and Materials located within the appendix of this specification.

The complete installation shall be inspected, tested and commissioned on completion.

Complete installation shall be labelled, inspected, tested and commissioned in accordance with the following standards:

- BS EN 50174-1
- BS EN 50174-2
- BS EN 50174-3
- BS EN 50346
- FIA-TSD-2000-4-2-1Optical Fibre Cabling: Testing of installed cabling: LSPM (Light Source and Power Meter) equipment.
- FIA -TSD-2000-4-2-2 Optical Fibre Cabling: Testing of installed cabling: OTDR (Optical Time Domain Reflectometer) equipment.
- FIA-TSD-2000-4-2-3 Optical Fibre Cabling: Testing of installed cabling: Specification, procurement and use of test cords.
- BS EN 61280-4-1
- BS EN 61300-3-35
- PD IEC/TR 62627-01

The Contractor shall provide confirmation through the Principal Contractor when it is considered the installation is complete and they are ready to provide all attendances and offer the installation for inspection and demonstration in the presence of the Engineer. A subsequent date shall be arranged for demonstrations of the installation and systems to the Client or their representative. Where the installations required a specialist to be appointed, the specialist shall also be available for the demonstrations.

wPART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATION

Refer to 200012-XX-XX-SP-E-002 'Y Sections' for reference specifications.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W70

300.005 PRECEDENCE AND APPLICATION OF STANDARDS:
- National standards precede regional standards, which in turn precede international standards.
- This specification is based on UK and European Standards, to achieve an approach for safety and compatibility for electrical, data network and information technology installations, and equipment, aligning with the European Committee for Electro technical Standardisation (CENELEC) approach.
- Identify any instances where the proposed solution does not conform to the above.

300.010 AMENDMENTS AND REVISIONS:
- Comply with any published amendments and revisions to standards, requirements and recommendations issued up to and including start on-site (and subsequently where the contractor can reasonably be assumed to be able to comply).

300.020 STANDARDS CONTRADICTIONS:
- Confirm that this document has been checked to identify any areas it appears to contradict any of the standards referenced in this document.

300.030 STANDARDS:
- Carry out work in accordance with the following standards and all standards that are referenced within
  - Standard
    - BS EN 50173-1
    - BS EN 50173-2
    - BS EN 50173-3
    - BS EN 50173-4
    - BS EN 50173-5
    - BS EN 50173-6
    - BS EN 50174-1
    - BS EN 50174-2
    - BS EN 50174-3
    - BS 6701
    - BS 7671
    - BS EN 50346
    - BS EN 61280-4-1
    - BS EN 61280-4-2
    - BS EN 61300-3-35
  - PD IEC/TR 62627-01
- Provide the entire copper structured cabling system from a single manufacturer.
- Provide the entire optical fibre structured cabling system from a single manufacturer.

300.050 INDUSTRY PRACTICE:
- Carry out work in accordance with the following industry practices:
  - Ensure that the structured cabling system is fully compliant with the Fibre optic Industry Association (FIA) code of practice for the testing and installation of optical fibre cables and assemblies
    - FIA-TSD-2000-4-2-1 Optical Fibre Cabling: Testing of installed cabling: LSPM (Light Source and Power Meter) equipment.
    - FIA-TSD-2000-4-2-2 Optical Fibre Cabling: Testing of installed cabling: OTDR (Optical Time Domain Reflectometer) equipment.
    - FIA-TSD-2000-4-2-3 Optical Fibre Cabling: Testing of installed cabling: Specification, procurement and use of test cords.

300.060 MANUFACTURER'S GUIDELINES:
- Carry out work in accordance with the manufacturer's requirements, guidelines and recommendations.

300.080 ELECTROMAGNETIC COMPATIBILITY:
- Ensure all cabling is installed considering the requirements of BS 6701, BS 7671, BS EN 50174 series and manufacturer's instructions.
- Provide earthing and bonding in line with manufacturer's recommendations, BS 6701, BS 7671 and BS EN 50310

310.000 SCHEDULE OF RESPONSIBILITIES
- Carry the work indicated on the following schedule and check the work indicated is to be carried out by the client or other is done in accordance with the programme.
- Except if and where marginally varied by the detail later in the specification, the schedule reference below indicates which items are part of the SCS contract and which items are excluded from their contract, and therefore provided by others as noted.
- Schedule reference Structured Cabling Responsibilities
    - Refer to clause 100.040 and drawing series E-304.

310.010 ROOM TERMINOLOGY:
- Note, the following room terminology is utilised throughout this work section:
  - Building Entrance Facility
    - Accommodation for
      - Termination of external cabling where it enters the building as a contractual interface.
      - Conversion of cables from external to internal fire performance.
  - Floor Equipment Room
    - Accommodation for
      - Termination point of horizontal cabling subsystem (Floor Distributor FD).
      - Active distribution equipment.
  - Building Equipment Room
    - Accommodation for
      - Termination point for campus backbone cabling subsystem (Campus Distributor CD).
      - Termination point of building backbone cabling subsystem (Building Distributor BD).
      - Termination point of horizontal cabling subsystem.
      - Active core equipment.
      - Active distribution equipment.
  - Server Room
    - Accommodation for
      - Server equipment.
      - Storage area network equipment.
  - Backup equipment.

310.020 TERMINOLOGY:
- The following terminology is used throughout this section:
  - Telecommunications Outlet (TO). Fixed connecting device where the horizontal cabling terminates (the telecommunications outlet provides the interface to the work area cabling).
  - Floor Distributor (FD). Distributor used to make connections between the building backbone cabling subsystem, active equipment (see Telecommunications Room) and cabling subsystems specified in:
    - Standard
      - BS EN 50173-1
      - BS EN 50173-2
      - BS EN 50173-3
      - BS EN 50173-4
      - BS EN 50173-5
      - BS EN 50173-6
  - Building Distributor (BD). Distributor in which the building backbone cable(s) terminate(s) and connections to the campus backbone cable(s) may be made.
  - Campus Distributor (CD). Distributor from which the campus backbone cabling emanates.
  - Data Patch Panel (DPP). Active data equipment termination point.

- Building Entrance Facility (BEF). Facility that provides all necessary mechanical and electrical services, that complies with relevant regulations, for the entry of telecommunications cables into a building and which may allow for transition from external to internal cable.
- Link. The transmission path between two specified test interfaces of generic cabling such as the TO (Telecommunications Outlet) and the HD (Horizontal Distributor).
- Channel. Any transmission path comprising passive cabling components between application-specific equipment or between an external network interface and application-specific equipment.

320.010 HORIZONTAL CABLE:

- Cables supplied must conform to the construction and performance requirements for the required category and design of cable being used to support the class of performance required for the cabling system.
- Sheath sharing is not recommended unless approved by the cabling system manufacturer.
- All 4 pairs in a 4 pair cable must be terminated at both ends of the link.
- Use of single manufacturer products is recommended throughout the cabling system.
- A manufacturer originated performance warranty and application support statement must be provided for the completed cabling system following installation and testing.
- Copper cable type
  - Unscreened/Unscreened Twisted Pair (U/UTP). No screen cable, previously referred to as UTP.
- Sheath composition
  - The fire performance of the cable sheath must support the requirements of the site fire assessment.
  - Ensure that the manufacturers bend radius is not exceeded throughout the installation by selecting containment and pathways which protect the cables.
- Termination of the cables into connectors must be in accordance with the recommended practices from the cabling system manufacturer.
- Ensure each cable and each sheath is continuous throughout its route length with no cable splicing or joints.
- Minimum cable for a link length will be specified by each cabling system manufacturer. Consult the cabling system manufacturer and obtain their approval for the combination of cable types and lengths being installed, including any cordage to connect links to equipment.
- Notify the relevant parties if works installed by others may mean that it would be difficult or impossible to meet the bending radii requirements.
  - Install cables in the relevant containment as shown on the drawings and schedules.

320.020 USER OUTLETS:

- Provide user outlets in the quantities and locations necessary to support the user's voice, data and BMS requirements as shown on the drawings and schedules.
- Provide an administration and/or labelling scheme where described in the scope of works in accordance with
  - Standard
    - BS EN 50173-1
    - BS EN 50173-2
    - BS EN 50173-3
    - BS EN 50173-4
    - BS EN 50173-5
    - BS EN 50173-6
    - BS EN 50174-1
    - BS EN 50174-2
    - BS EN 50174-3
- Clear, fade resistant labels to be provided on outlet faceplates at both ends of all cables and on the termination panels. Approval must be sought from the cabling system owner/operator for the style, font, size, colour and presentation of labels before deployment.
- Type
  - Floor box user outlets.
  - Pickup module user outlets.
  - Surface user outlets.

- Ceiling user outlets.
- Server user outlets.
- Slab box user outlets.

- The location and quantity of the user outlets are detailed in schedule reference Structured Cabling User Outlets
- Provide all face-plate outlets to be modular snap fit, such that one can be removed from a face-plate without affecting the others. Note, this applies to face-plates not patch panels.

320.030 EQUIPMENT LOOMS:

- The cable style and performance shall match the remainder of the cables system components used throughout the installation.
- Locate the active network equipment in the equipment cabinets for the physical security, airflow management and protection, do not use or open frames. Locate the equipment loom patch panels in the floor distributors.
- Form the plug end of the looms neatly to plug into the active equipment (or left spare for future connection).
- Terminate or present the other end of the equipment loom on the active data RJ45 patch panel (DPP).
- Type
  - 8 way equipment loom
  - 12 way equipment loom
  - 16 way equipment loom
  - 24 way equipment loom
  - 48 way equipment loom

320.040 HORIZONTAL CABLE PRESENTATION:

- Present the horizontal cable on patch panels within cabinets or frames as defined later in this work section.
- Patch panel type
  - 1U - 24 port patch panel
  - 2U - 48 port patch panel
- Separate the patch panels by 1U cable tidies such that each cable tidy is followed by not more than 48 outlets, followed by a 1U cable tidy and so on, i.e. one cable tidy per 48 outlets plus one additional cable tidy.

320.060 SCHEMATIC DRAWINGS:

- Provide a schematic drawing showing the proposed layout of each of the floor distributors.

330.000 BUILDING BACKBONE CABLING SUBSYSTEM

- Provide, install and test the building backbone cabling subsystem.
- Type
  - Fibre.

330.010 FIBRE BACKBONE CABLING:

- The optical fibre solution used in this installation must be sourced from a single solution vendor and be supported by warranty for performance and application support using the configurations required by clients operations. Mixing and matching of components from different vendors is not permitted.
- Throughout all the client installation the preferred fibre types used are
  - Multi mode laser optimized 50/125 (OM4).
- The connector performance provided must be better than the maximum loss limits for the environment, cabling type and application being supported set out in
  - Standard
    - BS EN 50173-1
    - BS EN 50173-2
    - BS EN 50173-3
    - BS EN 50173-4

    - BS EN 50173-5
- BS EN 50173-6
- Type
    - Multi mode
- Cores
    - 16.

330.015 BUILDING BACKBONE - FIBRE PRESENTATION:
- Terminate and present the fibre backbone cable on patch panels within cabinets or frames as defined later in this work section.
- Patch panel type
    - 1U - 8 duplex circuits (16 cores) patch panel.
- Start and end each patching area with a 1U cable tidy, with each patch panel separated by 1U cable tidies. Provide the total amount of cable as the total amount of patch panels plus one additional cable tidy.

330.030 STRUCTURED CABLING SYSTEM:
- Provide copper backbone cabling from the building distributor to each floor distributor as follows:
- Topology
    - Star.
    - Diverse Star.
- Type
    - Multicore Category 6a
    - 4 pair category
- Building Distributor end termination
    - 4 pair RJ45.
- Floor Distributor end termination
    - 4 pair RJ45.
- Refer for size and quantity of the copper backbone cabling to schedule reference Copper Backbone

330.035 BUILDING BACKBONE - COPPER PRESENTATION:
- Terminate and present the copper backbone cable on patch panels within cabinets or frames as defined later in this work section.
- Patch panel type
    - 1U - 24 port patch panel.
    - 2U - 48 port patch panel.
- Separate the patch panels by 1U cable tidies such that each cable tidy is followed by not more than 48 outlets, followed by a 1U cable tidy and so on, i.e. one cable tidy per 48 outlets plus one additional cable tidy.

330.070 SCHEMATIC DRAWINGS:
- Provide a schematic drawing showing the proposed topology and connections of the
    - Building fibre backbone.
    - Building copper backbone.
    - Tie cables.

340.000 CAMPUS BACKBONE CABLING SUBSYSTEM:
- Provide campus backbone cabling system.
- Type
    - Fibre.

340.010 FIBRE BACKBONE CABLING:
- Provide fibre backbone cabling between the Building Distributors in each building as follows:
- Topology
    - Diverse Star.
- Type

- Multi mode 50/125.
- Grade
  - Duct.
  - Indoor/outdoor.
  - Outdoor.
- Cores
  - 16.
- Termination/connectors
  - MT-RJ.
  - LC.
  - SC.
  - ST.
  - FC/PC.

340.020 CAMPUS BACKBONE - FIBRE PRESENTATION:
- Terminate and present the fibre backbone cable on patch panels within cabinets or frames as defined later in this work section.
- Patch panel type
  - 1U - 16 port patch panel.
- Refer for size and quantity of the copper backbone cabling to
  - Schedule
- Start and end patching area with a 1U cable tidy, with each patch panel separated by 1U cable tidies. Provide the total amount of cable tidies the total amount of patch panels plus one additional cable tidy.

340.070 SCHEMATIC DRAWINGS:
- Provide a schematic drawing showing the proposed topology and connections of the
  - Campus fibre backbone.

350.000 PATCH CORDS AND FLY LEADS
- Utilise patch cords to patch the required services to the required outlets within both the Floor and Building Distributors.
- Note, fly leads are utilised to provide the final connection from the user outlet to the end device.
- Type
  - Copper.
- Fibre.

350.010 COPPER PATCH CORDS AND FLY LEADS:
  - Provide copper patch cords and fly leads composed of stranded not solid conductors and be provided with factory fitted RJ45 plugs

350.020 FIBRE PATCH CORDS:
- Provide fibre patch cords.
- All connectors to be factory fitted.
- Test certificate with test results supplied.

350.030 PATCH CORD INSTALLATION:
- Install the following patch cord type to ensure the correct device is patched to the correct service
  - Copper.
  - Fibre.
  - All optical fibre cords must be inspected with a microscope and if required cleaned before insertion into a patch panel or outlet.

350.040 FLY LEAD INSTALLATION:
- Install all fly leads to ensure the correct device is connected to the correct user outlet. The responsibility for production of the patching schedule is
  - Client.

360.000 CABINETS AND FRAMES

360.010 CABINETS:

- Provide cabinets
  - Doors
  - Ventilation
  - 19" blanking panels
  - Multi point earthing strip
  - Internal additional earthing / bonding to power distribution strip protective earth and metallic parts of cabinet
  - Earthing / bonding connection to Common Bonding Network or Mesh-Bonding Network
- Standards
  - BS 7671
  - BS EN 50310
  - BS EN 60950-1
  - BS EN 62368-1
  - BS EN 60297-3 series
  - BS EN 60917 series
- Provide cabinets to house the building and floor distributors and the following equipment as provided by others:
  - Active data equipment.
  - UPS.
  - CCTV equipment.
- Type
  - Free-standing.
  - Wall-mounted.
    - Hinged
- Size and quantity of the cabinets are detailed in schedule reference Structured Cabling Cabinets
- Cabinets to be of steel construction throughout.
- Access
  - Front door
    - Single side hinged.
    - Mesh.
    - Steel.
    - Hinged opening with lift-off capability.
    - Lock and key.
  - Rear door
    - Single side hinged.
    - Mesh.
    - Steel.
    - Hinged opening with lift-off capability.
    - Lock and key.
  - Side panels
    - Lift-off.
    - Quick release panels.
  - Cable entry
    - Bottom.
    - Top.
- Ancillaries
  - Levelling feet.
  - Air management blanking plates
  - Fan tray - if required.
  - Power distribution strips.
- Install cabinets that are immediately adjacent to each other with no side panels, bayed together.
- Provide vertical cable containment, installed vertically in the middle of each side.

Provide vertical patch cord guides to manage patching, installed vertically at left and right of the front and similarly at the rear for cabinets with front and rear patching.

370.000 INSTALLATION:

- Ensure all manufacturer guidelines, main contractor site rules and client requirements detailed within the complete tender documentation are followed.
- Carry out all installation works in accordance with the site health and safety file, with the contractor ensuring their areas of responsibility operate in a clean and tidy environment. Ensure all outlets are protected from dust ingress.

370.040 TESTING:

- Carry out full testing as specified in the standards for all elements of the structured cabling system, and obtain appropriate passes for each element such as to ensure total structured cabling system compliance with the standards.
- Tests to include but not be limited to
  - Testing in accordance with the manufacturer's standards and the following BS EN and FIA standards
    - BS EN 50346
    - FIA-TSD-2000-4-2-1 Optical Fibre Cabling: Testing of installed cabling: LSPM (Light Source and Power Meter) equipment.
    - FIA-TSD-2000-4-2-2 Optical Fibre Cabling: Testing of installed cabling: OTDR (Optical Time Domain Reflectometer) equipment.
    - FIA-TSD-2000-4-2-3 Optical Fibre Cabling: Testing of installed cabling: Specification, procurement and use of test cords.
    - BS EN 61280-4-1
    - BS EN 61280-4-2
    - BS EN 61300-3-35
    - PD IEC/TR 62627-01
- Tests carried out on the voice cabling to include but not be limited to
  - Full continuity tests on every conductor.
  - Polarity tests on every pair.
- Tests carried out on the fibre optic cabling to include but not be limited to Light Source and Power Meter tests.
- All test results for copper and optical fibre must be produced by electronic means and submitted in electronic versions along with any tester specific software to review, read and analyse them. All software is to be provided free of charge and license free.
  - CD
- Tests to be carried out on cabinet / rack installations to include inspection and testing required by BS 7671, including but not limited to continuity of earthing / bonding conductors.

370.050 TESTING EQUIPMENT:

- List and describe the proposed testing equipment which will be used on-site and/or in their factory.
- Provide copies of valid calibration certificates for all equipment used for testing to the client or their agents at their premises with reasonable notice.
- Provide sample test result sheets for each of the tests to be carried out.

370.060 INSPECTION CHECKS:

- Note, during the installation period the client or their agents will make various physical inspections of the installation, including but not limited to: standard of workmanship, standards adherence, labelling, monitoring of the testing process, review of test results.
- Also note, the client or their agents will carry out witness checks of about 10% of the structured cabling system and the testing. Ensure reasonable notice is given before commencement of any tests.
- Also note before hand over and after full testing by the contractor, the client or their agents will carry out random sample tests to confirm the quality of the installation. Tests will include electronic tests, inspection of labelling and workmanship.
- Make available all personnel and equipment required to enable the client or their agents to carry out

any of the above checks, both on-site and/or in their factory.

370.070 AS INSTALLED INFORMATION:

- Provide an operations manual that explains how to use the structured cabling system and describes what can and what cannot be connected to it.
- Provide the as installed information as defined below and in accordance with the main contract requirements. Provide this information as part of the systems operations manual.
  - Drawings
    - Equipment room plan.
    - Equipment room elevation.
    - Outlet positions.
  - Schedules
    - Cables and outlets.
    - Test results.
  - Component descriptions.
  - Handover certificate.
  - Warranty certificate.

370.080 LABELLING:

- Propose and provide an appropriate identifier schedule and labelling scheme modified by the clients' requirements for scope and colours based on the requirements of
  - Standard
    - BS EN 50173-1
    - BS EN 50173-2
    - BS EN 50173-3
    - BS EN 50173-4
    - BS EN 50173-5
    - BS EN 50173-6
- Provide appropriate labelling for all elements of the scheme, including, where agreed
  - Horizontal cabling subsystem
    - Horizontal cable (both ends as a minimum).
    - User outlet.
    - Patch panel, both the panel and the outlet.
  - Building backbone cabling subsystem
    - Backbone cable (both ends as a minimum).
    - Patch panel, both the panel and the outlet.
  - Campus backbone cabling subsystem
    - Backbone cable (both ends as a minimum).
    - Patch panel, both the panel and the outlet.
  - Fly leads (both ends as a minimum).
  - Cabinets and frames.
- Label cables at all points where they enter or exit from concealment.
- Ensure that labels are suitably durable so as to remain functional for the life of the cabling system.
- Prove labelling is machine produced. Ensure that hand written labels are not used.
- Label patch panel of 2 rows of characters, top row to be common to the complete length of the patch panel and be descriptive of the outlet type, i.e. 1st Floor User Outlets, the bottom row to identify each individual outlet.

370.090 LABELLING SCHEME:

- Adopt the proposed labelling scheme identified below.

370.092 HORIZONTAL CABLING SYSTEM:

- Uniquely identify each user outlet using the following notation (note, fields are only required where category is included in the scheme):
  - End A Campus - Building - Floor - Comm's Room - Cabinet or Frame - Vert (patch panel location) - Outlet.

- Floor - Outlet - Cable or Outlet Performance.
- Uniquely identify each horizontal cable at both ends using consecutive numbers.
- Uniquely identify each fly lead at each end to match the user outlet.

370.094 BUILDING BACKBONE CABLING SUBSYSTEM:

- Uniquely identify each backbone cable at both ends containing an identifier/description for both the source and the destination of the cable. Uniquely identify each pair or outlet within each backbone cable at both ends as a 2 or 3-digit number running sequentially
  - End A Campus - Building - Floor - Comm's Room - Cabinet or Frame - Vert (patch panel location) - Outlet.
  - End A Campus - Building - Floor - Comm's Room - Cabinet or Frame - Vert (patch panel location) - Outlet - Cable or Outlet performance.
  - Uniquely identify each fly lead at both ends to match the patched locations in the comm's room (outlet to outlet or outlet to equipment).

370.096 CAMPUS BACKBONE CABLING SUBSYSTEM

- Uniquely identify each backbone cable at both ends containing an identifier/description for both the source and destination of the cable. Uniquely identify each pair or outlet within each backbone cable at both ends as 2 or 3-digit number running sequentially.
  - End A Campus - Building - Floor - Comm's Room - Cabinet or Frame - Vert (patch panel location) - Outlet.
  - End A Campus - Building - Floor - Comm's Room - Cabinet/Frame - Vert (patch panel location) - Outlet - Cable or Outlet performance.
- Uniquely identify each fly lead at both ends to match the patched locations in the comm's room (outlet to outlet or outlet to equipment).

380.000 WARRANTY:

- Provide a warranty for the complete structured cabling system.
- Type
  - Major structured cabling manufacturer warranty.
- Duration of the warranty from the handover date of the completed system for a minimum of:
  - 20 years.
- Cover appropriate extensions to the structured cabling system by the warranty. Appropriate extensions to be those which meet the manufacturer's design guides, installed by the contractor (or by any other contractor registered with and authorised by the end manufacturer as a certified installer) using certified components and procedures as prescribed by the manufacturer.
- Arrange for the structured cabling manufacturer to visit site during the installation and at practical completion and confirm to the client, or their agents, manufacturer compliance.
- Ensure the warranty is not voided by normal use of the system, including moves and changes carried out by the client or their agents.
- Ensure the warranty provides for the client or their agents to contact the contractor in the first instance, who shall attend the site within one working day to carry out appropriate tests and who will then progress the claim through the manufacturer. Agree action on the claim and initiate within 10 working days of notification of the claim. Ensure the action shall be completed without unreasonable delay.
- Arrange a contract between the client and the manufacturer such that if the contractor is no longer in existence (or in the event of non-performance by the contractor) then the manufacturer shall fulfil all the obligations of the contractor.

State the name, address and claim contact details (department name, person's name and phone number) of the manufacturer. This may be used to verify that the warranty is fully compliant with the above requirements.

APPENDICES

APPENDIX A – SCHEDULE OF SPECIALIST SUPPLIERS, MANUFACTURERS AND MATERIALS

SCHEDULE OF SPECIALIST SUPPLIERS AND MANUFACTURERS

The following materials, equipment, manufactures and specialist suppliers listed within the schedule below **must be used within the tender offer**.

Several manufacturers or suppliers may have been provided for a particular items of equipment, system or specialist supplier to give a reasonable choice to the Electrical Sub-Contractor who may choose which of the manufacturers, or specialists they wish to include within the tender offer. However, the item must be obtained in whole from one manufacturer and be fully compliant with the tender specification / documentation and drawings.

Where materials, equipment, manufactures or specialist suppliers have not been listed for certain minor items of equipment, the Electrical Sub-Contractor may offer equipment from a manufacturer which meets the specification and be suitable for the intended use. Any equipment chosen shall be of a good quality and fit for purpose.

Where material, equipment, or manufacture is subject to being **"Equal",** the Electrical Sub-Contractor may select material, equipment or a manufacturer equal in aesthetics, construction and performance to the original material, equipment or manufacturer listed.

Where material, equipment, manufacture or specialist supplier is subject to being **"Equal and Approved",** the Electrical Sub-Contractor may offer for consideration and approval, an alternative to the original item specified for the Contactor Administrator/Engineer to consider the alternative. The Electrical Sub-Contractor shall issue a technical submission demonstrating the aesthetics, construction and performance characterises are equal to or exceeds that of the specified item. There is no guarantee the alternative item will be approved for inclusion within the tender offer. Approval for the alternative item to be included within the tender offer will only be granted by the Engineer in writing. In addition, any cost saving benefit back to the Client shall be scheduled within the Tender Summary documentation to be returned as part of the tender offer.

The Electrical Sub-Contractor may suggest an alternative where it is felt there is a significant cost saving benefit back to the Client, however, there is no guarantee this will be accepted. The Electrical Sub-Contractor shall submit with their tender offer a technical submission and cost benefit for consideration. The technical submission shall demonstrate the alternative is equal in aesthetics, construction and performance to the original equipment or manufacturer listed. In addition, any cost saving benefit back to the Client shall be scheduled within the Tender Summary documentation to be returned as part of the tender offer.

SCHEDULE OF MANUFACTURERS & MATERIALS

Item	Manufacture	Range	Equal	Equal & Approved
Main LV Switchgear				
Switchboard / panel.	Schneider Electric Approved switch-panel manufacturer	-	-	✓
Protection devices. (4P3D & 2P1D)	Schneider Electric	NSX + adjustable LSI settings	-	✓
Non-fiscal metering.	Schneider Electric	Manufacturers Standard	-	✓
Fiscal metering.	Schneider Electric	Manufacturers Standard	-	✓
Transient voltage surge protection.	Schneider Electric	Manufacturers Standard	-	✓
Power Conditioning				
Power factor correction. (Automatic)	Schneider Electric	Varset LV	-	-
Harmonic filtering. (Detuned Capacitors)	-	-	-	-
Sub-Distribution Switchgear				
Switchboard / panel.	Schneider Electric	Power Pact range	-	✓
Protection devices. (4P3D & 2P1D)	Schneider Electric	NSX + adjustable LSI settings	-	✓
Non-fiscal metering.	Schneider Electric	Manufacturers Standard	-	✓
Fiscal metering.	Schneider Electric	Manufacturers Standard	-	✓
Final Distribution				
Distribution boards.	Schneider Electric	Acti 9 Isobar	-	✓
Consumer units.	Schneider Electric	Acti 9 isobar	-	✓
Protection devices.	Schneider Electric	IC60H	-	✓
Energy metering.	Schneider Electric	Manufacturers Standard	-	✓
Transient voltage surge protection.	Schneider Electric	Manufacturers Standard	-	✓
Cabling Systems				
High Voltage (11kV) and Low Voltage Electric Cables.	Full associate member of the British Cable Association	The British Approvals Service shall approve all cabling. The trademark “BASEC” shall be marked on the cable together with the manufacturers traceability mark.	-	-
Containment				
Cable ladder.	Legrand	Swifts	-	✓
Cable tray.	Legrand	Swifts	-	✓
Cable trunking (IP & non IP rated).	Legrand	Salamander	-	✓
Lighting trunking (with metal capping)	Legrand	Salamander	-	✓
Cable basket.	Legrand	Cablofil	-	✓
Dado trunking (uPVC)	Schneider Electric Marco MK Electric	Ultimate 60 Elite 3	-	✓

SCHEDULE OF MANUFACTURERS & MATERIALS

Item	Manufacture	Range	Equal	Equal & Approved
	Marshel Tufflex	Prestige 3D XL 201		
Bench Trunking (uPVC)	Schneider Electric Marco Marshal Tufflex	Bench Trunking	-	✓
Skirting Tunking (uPVC)	-	-	-	-
Underfloor trunking.	-	-	-	-
Cable ducts (Private).	Polypipe Naylor	Ridged smooth bore Twin wall smooth bore	✓	-
Cable ducts (Utilities).	Utility Company Suppliers	To meet utility suppliers specifications	-	-
Lighting				
Luminaires.	-	Refer to Luminaire & Controls Schedule	-	✓
Light switches (grid switch).	MK Electric	General 10AX Logic Plus Engineering / DT / External Store & Plant Rooms / Building Metalclad Plus Ingress Protected (min IP66) Masterseal Plus	-	✓
Occupancy sensors.	-	Refer to Luminaire & Controls Schedule	-	✓
Standard 6A Plug-in ceiling rose (single socket).	MK Electric Hagar Electric	Link Klik	-	✓
Lighting control and Marshalling connection boxes..	-	Refer to Luminaire & Controls Schedule	-	-
16A GST Plug-in ceiling rose (single plug & socket arrangement)	CP Electronics	Vitesse	-	✓
Time clocks. (2C digital time switch - 24 hours + 7 days)	Schneider Electric	Acti 9 , IHP+	-	✓
Photocell.	Thorn Lighting Lucy Zodion Royce Thompson	To suit specified requirements.	-	-
Lighting contactors.	Schneider Electric	ICT Modular 40A rating.	-	✓
External lighting				
Luminaires.	-	Refer to Luminaire & Controls Schedule	-	✓
Lighting columns/spigots/brackets.	Abacus Lighting BEI Lighting Valmont Stainton Luminaire Manufacturer	To suit specified requirements.	-	✓
Street lighting cut-outs (double pole, fused).	Lucy Zodion	Titan	-	✓
Small Power				
13A D.P. single and double switched / non switched socket outlets.	MK Electric	General Logic Plus Engineering/ DT / External Store & Plant Rooms / Building	-	✓

SCHEDULE OF MANUFACTURERS & MATERIALS

Item	Manufacture	Range	Equal	Equal & Approved
		Metalclad Plus Ingress Protected (min IP66) Masterseal Plus		
13A D.P. switched / non-switched fused connection units with or without secret.	MK Electric	General Logic Plus Engineering / DT / External Store & Plant Rooms / Building Metalclad Plus Ingress Protected (min IP66) Masterseal Plus	-	✓
20A D.P. switch with / without indicator or secret flex outlet.	MK Electric	General Logic Plus Engineering / DT / External Store & Plant Rooms / Building Metalclad Plus	-	✓
32A D.P. switch with / without indicator.	MK Electric	General Logic Plus Engineering / DT / External Store & Plant Rooms / Building Metalclad Plus	-	✓
50A D.P. switch with / without indicator.	MK Electric	General Logic Plus Engineering / DT / External Store & Plant Rooms / Building Metalclad Plus	-	✓
45A D.P. Cooker control switch and 13A socket outlet with or without neon indicators.	MK Electric	Logic Plus	-	✓
45A Cooker connection unit (single outlet).	MK Electric	Logic Plus	-	✓
10A Three pole fan isolator.	MK Electric	General Logic Plus Engineering / DT / External Store & Plant Rooms / Building Metalclad Plus	-	✓
Shaver/toothbrush supply unit. (integral double wound transformer)	MK Electric	Logic Plus	-	✓
Media Plates.	MK Electric	Logic Plus	-	✓
BS 60309 Industrial plug and sockets.	MK Electric ABB Legrand	Commando Industrial P17 Tempra	-	-
Structured Cabling				
Data/Voice floor standing cabinets.	Excel Networking	By Data & Voice Specialist	-	✓
Data/Voice wall mounted cabinets.	Excel Networking	By Data & Voice Specialist	-	✓
Patch panels.	Excel Networking	By Data & Voice Specialist	-	✓
Network & Structured cabling.	Excel Networking	By Data & Voice Specialist	-	✓
Patching leads	Excel Networking	By Data & Voice Specialist	-	✓
Data/voice modules	Excel Networking	By Data & Voice Specialist	-	✓
Data/voice face plates	MK Electric	General Euro Modular Front plate Engineering / DT / External Store & Plant Rooms / Building Metalclad Plus	-	✓

SCHEDULE OF MANUFACTURERS & MATERIALS

Item	Manufacture	Range	Equal	Equal & Approved
		Ingress Protected (min IP66) Masterseal Plus		
Fire Detection and Alarm				
Fire detection and alarm system	Advanced Fire Gent Honeywell	MX Pro 5 Vigilon Plus	-	✓
Fire alarm network and loop cards	Advanced Fire Gent Honeywell	To match operating protocol.	-	✓
Fire alarm manual call point (Non addressable – key switch operation)	KAC Alarm Company	Conventional, Key switch, Removable key	-	✓
Fire detection devices.(addressable)	Apollo Fire Gent Honeywell	Discovery S Quad	-	✓
Fire alarm and Peripherals	Apollo Fire Gent Honeywell	Discovery Vigilon	-	✓
External IP rated manual call point covers	Security Safety Products	External IP66/IP56 rated Water-tight Fire Alarm Call Point Cover (excludes MCP)	✓	✓
Class Change Time clock	Danfloss	2 channel, 842 Range	-	✓
Lock Down Alarm	HAES	Lock Down Alert Alarm Pulsing Relay		
Aspirating smoke detection system.	Apollo Fire Detectors Ltd Gent Honeywell	Discovery ASD FAAST	-	-
Radio alert system.	-	-	-	✓
Emergency voice communication system	Boxhall Baldwin Gent Honeywell	Care 2 Compact 9	-	-
Emergency voice communication system intercom units.	Boxhall Baldwin	Type B Units to match control panel.	-	✓
Fire door “Hold Open” devices	Gent Honeywell	Door Holder	-	✓
Fire door “Hold Open” devices power supply unit.	Gent Honeywell	Transformer Rectifier PSU	-	✓
Intruder Detection and Alarm				
Intruder detection and alarm system control panel. Grade 3	Honeywell	Galaxy Dimension	-	✓
Dual technology motion sensors. Grade 3	Honeywell	By Security Specialist	-	✓
Magnetic door contacts. Grade 3	Honeywell	By Security Specialist	-	✓
Panic buttons. Grade 3	Honeywell	By Security Specialist	-	✓
Ancillary items	Honeywell	By Security Specialist	-	✓
Door Entry / Access Control				
Access control system.	Paxton	Net 2 Pro	-	✓
Proximity card/fob readers (Internal)	By Access Control Specialist	By Access Control Specialist	-	✓
Proximity card/fob readers (External)	By Access Control Specialist	By Access Control Specialist	-	✓

SCHEDULE OF MANUFACTURERS & MATERIALS

Item	Manufacture	Range	Equal	Equal & Approved
Press to release switches.	Specialist Security Supplies	By Access Control Specialist	-	✓
Emergency release units.	By Access Control Specialist	By Access Control Specialist	-	✓
External IP rated emergency release unit covers	By Access Control Specialist	Alarmed External IP66 rated Weather Resistant Press to Exit | Break Glass Enclosure (excludes emergency release unit).	✓	-
Door entry remote pedestals.	By Access Control Specialist	By Access Control Specialist	-	✓
Intercom system.	Paxton Bticino Videx	By Access Control Specialist	-	-
Ancillary items.	Paxton Bticino Videx	By Access Control Specialist	-	-
Closed Circuit Television System				
Central Management Software .	Honeywell	HDCS	-	✓
Network / digital video recorder.	Honeywell	Performance Series	-	✓
Video recorder rack mount tray.	Honeywell	For Performance Series VR	-	✓
Static cameras / brackets	Honeywell	IR rugged dome IP cameras	-	✓
Pan, tilt and zoom cameras/ brackets	Honeywell	HDZ IP IR PTZ cameras.	-	✓
Ancillary items.	Honeywell	By CCTV Specialist	-	✓
Other Systems				
Audio frequency loop induction system.	Ctec	By AFLI Specialist	-	✓
Infra Red Hearing Systems	Sennheiser	By AFLI Specialist	-	✓
Accessible WC call system	Ctec	Conventional range	-	✓
Equipment & Appliances				
Hand Dryers (stainless steel, max 65dBA, 30 sec drying)	Airdri	Airdri Quote™	-	✓
EV Chargers	Rolec EV	Autocharge:EV	-	✓
PV Installation	Solarsense	-	-	✓

SCHEDULE OF SPECIALIST SUPPLIERS

System	Specialist
Lighting controls.	Lighting control manufacturer/supplier
Data & voice specialist	Excel Certified Specialist.
Fire detection and alarm	BAFE Approved Fire Alarm Specialist.
Aspirating Smoke Detection	
Emergency Voice Communication Systems	
Intruder detection and alarm system.	SSAIB / NACOSS / NSI Gold Approved Specialist.
Door entry / access control system.	
Closed circuit television system.	
Disabled WC Call Systems	Equipment Manufacturer Certified Specialist
Audio frequency loop induction / Hearing Loop systems.	Equipment Manufacturer Certified Specialist
Lightning protection system.	PTSG Ltd Omega Red Group Ltd ESS Group
Photovoltaic System	MCS Certified Installer